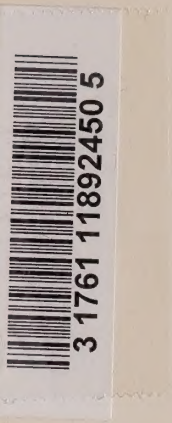

Reduction of Energy Use and Emissions in Ontario's Transportation Sector

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Submitted to:

Ontario Ministry of Energy
Ontario Ministry of the Environment
Ministry of Transportation of Ontario

Submitted by:

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Preface

The study team acknowledges the assistance of the project steering committee:

Doug MacCallum, Martin Whicher and Ladan Mahboobi: MENY
Craig Willis, Terry Robbins, and Joan O'Mara: MTO
Ian Johnson, MOE

Each of the members of the steering committee offered insightful comments on interim and draft material, and provided relevant references.

Pilorusso Associates Ltd. assisted in preparing the unit emissions factors, the base case emissions estimates, and the assessment of alternative fuels and inspection and maintenance programs.

McCormick Rankin prepared the regional analyses, the assessment of potential transit modal shares, and the potential for HOVs.

At VHB, most work was undertaken by David Heeney, Murray Trott and Perry Graham. Mr Heeney was the project manager and assumed overall responsibility for the project. Mr Trott undertook most of the economic analyses and prepared the assessment of economic instruments. Mr Graham assisted in data analysis and in the assessment of the potential for improving automobile and light truck fuel economy. In addition, Peter van den Bergh undertook analyses of the potential for bicycles and changes in land use planning. Evelyn Nepom assisted in the data analysis for emissions, and provided research support. Finally, Terry Burrell provided input into the overall approach, including identifying actions and measures, and developing scenarios.

Executive summary

This report reviews opportunities to reduce emissions and energy use in Ontario's transportation sector over the next fifteen years. It does this by considering current and projected energy use and emissions with and without the adoption of regulatory, economic and information measures to discourage energy use.

The study considers energy use by fuel type, and six pollutants: carbon dioxide, carbon monoxide, sulphur dioxide, nitrogen oxides, volatile organic compounds, and particulates. Energy use and transportation demand estimates for 1988 through 2005 in the base scenario are derived primarily from the Ontario Ministry of Energy's Transportation model. Unit emission factors are applied to energy use rates or vehicle distances travelled to estimate total emissions. The study does not consider emissions from energy production and distribution, or direct emission control technologies.

Based on a literature review, measures for reducing energy use or emissions were identified, and their possible effectiveness and implications for Ontario are assessed. Given existing commitments to reduce the conventional automotive pollutants, the study concentrated on opportunities to reduce carbon dioxide emissions through increased efficiency of energy use.

Eight types of measures, with several degrees of implementation for some of them are considered:

- improved vehicle fuel efficiency achieved through standards
- increasing the use of transit
- economic instruments, including "carbon taxes" and "gas-guzzler taxes" to discourage energy use

- changes to land use planning so that cities do not require as much transportation
- traffic management measures to reduce congestion and speed up traffic flow
- vehicle inspection and maintenance programs
- incentives for substituting communications for transportation
- regulatory restrictions on travel demand.

In addition, the potential contribution to energy or emissions reductions of alternative fuels and bicycling were assessed, but the potential was found to be very small.

Measures are assembled into regulatory, economic or mixed strategies for meeting three scenarios with different targets for reduction:

- reducing emissions with "cost-effective" technology
- stabilizing emissions at 1988 levels by 2000, and then maintaining that level
- reducing total emissions to 80 percent of the 1988 level by 2005
- reducing emissions to 80 percent of 1988 levels by 2005, while setting the stage for more dramatic cuts in CO_2 emissions which are deemed necessary to stabilize atmospheric concentration.

The analysis indicates that stabilizing emissions can be achieved using cost-effective measures, that is, measures that can be justified strictly on economic grounds.

Achieving higher levels of reductions is more difficult, and will require economic costs or lifestyle changes or both. The magnitude of these costs and changes in lifestyle depends on the policy mix selected. Vehicle technology improvements make the largest contribution to reductions, whether achieved through regulatory mechanisms or economic ones.

More detailed analyses will be required in advance of implementation of any of the measures reviewed.

Abbreviations

a	the SI symbol for year (annum)
CAFE	combined average fleet efficiency
CO	carbon monoxide
CO_2	carbon dioxide
EMR	Energy, Mines and Resources Canada
HOV	high occupancy vehicle
J	the SI symbol for joule, a unit of energy
km	the SI symbol for kilometre
kt	the SI symbol for kilotonnes (10^3 t)
L	the SI symbol for litre
MENY	Ontario Ministry of Energy
NEB	the National Energy Board
NO_x	Nitrogen oxides
PAH	polycyclic aromatic hydrocarbons
PJ	the SI symbol for petajoule, or 10^{15} joules
t	the SI symbol for tonne (1000 kilograms)
USEPA	United States Environmental Protection Agency
VkmT	vehicle kilometres travelled
VOCs	Volatile organic compounds

1 Introduction

1.1 Background

The transportation sector in Ontario accounts for more than a quarter of the total end-use energy used in Ontario (Statistics Canada, 1989). The transportation sector accounts for an even larger fraction of refined petroleum products (72 per cent) and natural gas liquids (30 per cent). This is significant for several reasons:

- these energy sources are the most constrained from a supply perspective
- alternative energy sources for use in transportation are not well developed
- combustion of these fuels accounts for a significant component of air pollution, and contributions to climate change.

In Canada, the transportation sector accounts for more than 40 per cent of emissions of volatile organic carbons (VOCs), and more than 60 per cent of the emissions of nitrogen oxides (NO_x) (VHB,1989). The transportation sector also accounts for about 30 per cent of carbon dioxide (CO_2) emissions in Canada (Robinson, 1990).

The implications of these data are that the transportation sector is a key area to look for potentials to reduce energy use and emissions in Ontario.

1.2 Objectives and scope

The objectives are the study are as follows:

- to establish a baseline estimate of energy use and emissions associated with Ontario's transportation sector
- to identify measures that may be adopted to reduce energy use or emissions
- to select measures with the greatest opportunity for effecting energy use or emissions
- to develop a set of scenarios, consisting of groups of measures, and
- to assess the likely impacts of the scenarios on energy use and emissions, their costs, and their benefits.

The scope of the study excluded certain types of effects from consideration:

- emissions from energy production and distribution are not addressed
- direct emission control (pre- and post-combustion technologies) are not considered
- where measures lead to cost savings, the effects of the expenditure of these saved costs are not evaluated
- only the decrease in the amount of each type of emission is considered, the implications of these reductions is not addressed.

1.3 Methodologies

For the baseline energy estimates, the study relies primarily on model output from the Ontario Ministry of Energy (MENY) Energy Demand Model. This model provides highly disaggregated information on transportation demand, vehicle efficiencies, and fuel type. The baseline from the model was modified where more current or accurate data were identified.

The baseline emissions estimates are derived using standard factors from the technical literature, and are checked for consistency with other published estimates.

Measures, their effectiveness and their cost were identified from published studies.

Measures are selected for more detailed study based primarily on estimates of their effectiveness, and the confidence one can have in these estimates.

Scenarios are developed based on targets that have been proposed publicly. The scenarios use various combinations of regulatory and economic measures to achieve the targets.

The effects of the scenarios are estimated using an accounting framework that keeps track of changing demand levels and fuel efficiencies, the costs of achieving these, and the value of fuel savings.

2 Existing patterns of energy use and emissions

Assessing the impacts of strategies requires a baseline against which energy and emission levels associated with the strategy can be compared. Analyzing the effects of energy—or emissions—reducing measures requires the examination of the current state of output and consumption, as well as projections of current trends.

This chapter discusses Ontario's present and future production levels of energy and emissions.

2.1 Existing energy use

A number of organizations produce historical and projective estimates of energy use from transportation sources in Ontario and Canada. For most emission-producing sectors, including transportation, emissions are usually calculated from the source energy data.

When examining specific measures affecting selected modes and trip types, it is desirable to have data on a highly disaggregated level. In addition to base energy values for a variety of transit modes, the components of energy use (for example, distance travelled and fuel efficiency) are required. The MENY Energy Demand Model provides these data for present and future periods.

Table 2-1 presents the estimates of energy use for Ontario's transportation sector in 1988. The modes have been aggregated somewhat to simplify the display.

The source of most energy data in Table 2-1 is the MENY Energy Demand Model. Two changes were made to the vehicle demand, vehicle efficiency and energy demand base case developed from the model. "Truck" data were disaggregated into light trucks and other

(medium and heavy) trucks and the urban public transit numbers were improved to reflect more recent data. These modifications do not significantly affect the total energy forecasted by the MENY model but allow for improved modelling of emissions and energy demand for these modes.

2.2 Determinants of energy use

The determinants of energy use need to be identified before the effects of technology or policy can be analyzed. Most transportation energy forecast models determine total energy requirements by evaluating the following formula for each transportation mode:

*Energy Consumption = Energy/Unit of Transportation Activity * Amount of Activity* [1]

The analysis of future trends in transportation usually involves the examination of the effects time, technology, policy, or economics may have on *fuel consumption* (Energy/Unit of Transportation Activity), or *demand* (Amount of Activity). Decreasing these parameters will proportionately decrease the amount of energy used.

2.3 Projections of energy use

The MENY Energy Demand model evaluates the preceding equation for future scenarios. Table 2-1 presents the baseline estimates of energy use in Ontario over a 15 year forecast period.[1]

MENY's energy demand estimates for light trucks and urban public transit have been modified for future estimates also.

2.3.1 Energy estimates from other sources

MENY's energy estimates are compared below with independent studies.

[1] Appendix B presents this table in more detail.

Table 2-1
Estimates of annual energy use in Ontario

Sector/Mode	Energy Use (PJ/a)				
	1988	1990	1995	2000	2005
Auto	295	313	343	348	366
Truck	155	159	170	189	200
Airplane	60	61	70	76	85
Light truck	47	48	52	56	61
Rail	23	23	25	28	31
Marine	17	18	20	22	25
Other[a]	9	9	10	12	14
Bus	8	8	9	10	11
Streetcar & subways	1	1	1	2	2
GO-train	1	1	1	1	1
Total	615	641	702	744	794

[a] "Other" includes motorcycles, school buses and recreational vehicles.

Source: Based on MENY, 1988. *Transportation Energy Demand Forecast.* Computer printout from the Transportation model of the Ministry of Energy Energy Demand Model.
Note: Due to rounding errors, and some adjustments to allow light trucks to be shown separately, totals are slightly different from those estimated in MENY 1988.

Energy, Mines and Resources Canada

EMR's Energy and Fiscal Analysis Division produces reference and alternative case energy forecasts yearly. The 1989 issue relies on EMR's Inter-Fuel Substitution Demand model (IFSD) and predicts energy use to the year 2020.

The model produces energy use forecasts for various Canadian regions and sectors. Table 2-2 shows the Canadian and Ontario transportation sector forecasts for selected years.

Table 2-2
Energy, Mines and Resources annual energy demand in Ontario transportation sector (PJ)

Region	1988	1990	1995	2000	2005
Ontario	639.9	658.3	738.9	796.9	864.2
Canada	1,795.2	1,834.1	1,999.5	2,135.6	2,312.1

Source: Energy Mines and Resources Canada, *2020 VISION*, 1988 page B-13

National Energy Board

The National Energy Board Act requires that the NEB "keep under review the outlook for Canadian supply of all major energy commodities ... and the demand for Canadian energy in Canada and abroad" (National Energy Board, page i). The NEB consequently produces detailed energy forecasts every other year, the most recent was published in 1988 (NEB,1988).

Table 2-3 and Table 2-4 show the NEB's forecasts for two scenarios: a "low case" and a "high case". The former being a slightly more conservative outlook of Canada's future energy use.

Comparison of forecasts

The MENY, EMR and NEB forecasts all lead to results that are quite similar. Automobile and truck demand is a significant part of all the forecasts, and is largely determined by stock turnover rates and new vehicle efficiency, which is influenced by fuel costs. The Ontario MENY forecast was adopted for this study because it provides the most detailed breakdown of demand and demand determinants, and is thus the most amenable to the assessment of the effects of particular measures and actions.

2.4 Existing emissions

The transportation sector is a major source of air pollutants. Emissions from the transportation sector contribute to a large number of environmental issues, including: global warming; urban smog; adverse effects on human and animal health, terrestrial ecosystems, and aquatic ecosystems; damage to materials; and localized and urban impaired visibility. The emissions from transportation sources of most concern are: volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), diesel particulate, and oxides of sulphur (SO_x). Other more toxic compounds may be of concern in particular circumstances.

Table 2-3
National Energy Board Annual Energy Demand in Ontario Transportation Sector—High Case (PJ/a)

Fuel Type	1988	1990	1995	2000	2005
Motor Gasoline	427.3	437.8	481.9	513.0	539.4
Diesel Fuel Oil	127.7	138.8	162.4	180.8	198.9
Aviation Turbo-Total	55.4	57.6	61.4	63.9	67.5
Aviation Gasoline	1.5	1.5	1.5	1.5	1.5
Heavy Fuel Oil	9.4	8.5	7.9	7.3	6.8
Other	10.5	12.1	16.2	20.3	24.1
Total	631.7	656.3	731.2	786.8	838.1

Table 2-4
National Energy Board Annual Energy Demand in Ontario Transportation Sector—Low Case (PJ/a)

Fuel Type	1988	1990	1995	2000	2005
Motor Gasoline	428.8	438.7	484.2	509.5	527.9
Diesel Fuel Oil	128.4	139.9	161.7	173.9	185.5
Aviation Turbo-Total	56.3	58.1	59.0	60.8	62.0
Aviation Gasoline	1.5	1.5	1.5	1.5	1.5
Heavy Fuel Oil	9.5	8.7	8.4	7.6	7.0
Other	10.1	11.1	13.5	15.9	18.8
Total	634.7	658.1	728.3	769.1	802.5

There is an immense literature on the adverse effects of air pollution which is periodically summarized and presented in regulatory impact analyses of proposed regulations to lower emissions levels from transportation sources. For example, for a discussion of the adverse effects of light duty vehicles emissions see Kolomeychuk, (1983). For a summary of the adverse effects of heavy duty vehicle emissions see Pilorusso (1986). The U.S. Environmental Protection Agency periodically updates its Air Pollution Criteria Documents which contain exhaustive reviews of the adverse effects of each air pollutant. In summary there is an

abundance of literature on the subject of adverse effects of air pollution. Unfortunately, most of it is not very conclusive.

Environment Canada and Transport Canada (1989) have recently published national estimates of the portion of total emissions of each pollutant that are accounted for by transportation sources. Baseline and forecast emissions inventory data for NO_x and VOCs, disaggregated by province, were also recently published by the Federal/Provincial Long Range Transport of Air Pollutants Steering Committee (1990). The Ministry of the Environment periodically prepares emissions inventories for Ontario that include the portion of all emissions from transportation sources.

For each of the main pollutants from transportation sources, the relative contribution of transportation sources to total emissions and their adverse effects are summarized below. The summaries are drawn largely from the sources mentioned in the two previous paragraphs.

2.4.1 Volatile organic compounds (VOCs)

VOCs are the volatile portion of unburned hydrocarbons (fuel) that are emitted from vehicle engines. The main sources of unburned hydrocarbons are exhaust gases and evaporative losses from engines and during re-fuelling.

Gasoline-fuelled vehicles account for more than 85 per cent of VOCs from transportation sources. The transportation sector as a whole accounts for about 42 per cent of VOC emissions from all anthropogenic sources.

Some volatile organic compounds are irritants and so may effect exposed skin or other tissues. At high concentrations, these materials effect the brain and nervous system. At lower concentrations, overt effects are not commonly seen for most VOC. However, some VOC are considered toxic at low concentrations and have been associated with a variety of toxic effects, ranging from reproductive failure to cancer.

In addition, some types of VOC, often described as reactive organics (ROG), participate in the generation of ground-level ozone. When VOCs and NO_x interact in the atmosphere while exposed to sunlight they convert normal oxygen (O_2) to ozone (O_3). The major adverse effects of ozone are increased incidence of respiratory symptoms and aggravation of respiratory disease, damage to natural flora and agricultural crops.

2.4.2 Oxides of nitrogen (NO_x)

NO_x is a by-product of combustion, and is emitted in the exhaust gases from internal combustion engines.

Diesel-fuelled road vehicles and air, marine, and rail sources account for about 55 and 15 per cent, respectively, of NO_x emissions from transportation sources. The transportation sector accounts for about 63 per cent of NO_x emissions from all sources.

As well as being a precursor of ozone, elevated ambient concentrations of NO_x are responsible for a number of other adverse effects, including: irritation that may lead to discomfort or damage to exposed moist tissues including the lungs, fading of some fabrics, contribution of nitrate and nitric acid to acidic precipitation, and contribution to the formation of smog. Nitrous oxide accounts for about four per cent of the climate effect of 1990 anthropogenic emissions (IPCC,1990).

2.4.3 Carbon monoxide (CO)

CO is also a by-product of combustion.

Gasoline-fuelled road vehicles account for about 94 per cent of CO emissions from transportation sources. Diesel-fuelled trucks and air, marine and rail sources account for the remaining CO emissions from transportation sources.

Elevated ambient concentrations of CO result in a number of adverse health effects including: increased risk of heart attacks, aggravation of symptoms of cardiovascular disease, decreased work capacity, impaired vigilance and abnormal fetal development.

2.4.4 Carbon dioxide (CO_2)

CO_2 is another by-product of combustion of carbon-based fuels.

CO_2 emissions from transport vehicles account for between 25 and 30 per cent of total CO_2 emissions.

CO_2 is the main greenhouse gas, accounting for more than 60 per cent of the cumulative climate effect of anthropogenic emissions (IPCC,1990; Allen,1990). If atmospheric concentrations are to be stabilized at current levels, a reduction in the global level of CO_2 emissions of greater than 60 per cent is required (IPCC, 1990).

2.4.5 Diesel particulate

Diesel particulates are a component of diesel exhaust.

Transportation sources account for almost two-thirds of total diesel fuel oil consumption in Ontario (Statistics Canada, 1989), and could be expected to account for a comparable proportion of diesel particulate emissions.

Diesel particulate consists of approximately 65 to 80 per cent carbon (soot) (USEPA, 1984), 10 to 20 per cent sulphates (Weaver, Miller and Nelowet, 1984) and polycyclic aromatic hydrocarbons (PAHs). Soot is a major cause of smog. Sulphates contribute to acid precipitation. A number of PAHs found in diesel particulate are known and suspected carcinogens and mutagens.

2.4.6 Sulphur oxides (SO_x)

While transportation sources account for only 2 to 3 per cent of all SO_2 emissions[2], they are included here for the sake of completeness. SO_2 emissions are the primary cause of acidic precipitation.

2.5 Determinants of emissions

The emissions factors for sulphur dioxide (SO_2), oxides of nitrogen (NO_x), particulates, carbon monoxide (CO), and volatile organic compounds (VOC) in 1985 were provided by the Air Resources Branch of the Ontario Ministry of Environment. The carbon dioxide (CO_2) emissions factors are from Environment Canada (1990). The Air Resources Branch does not forecast emission factors—emission factors for future years were obtained from Environment Canada.

SO_2 emissions from the transportation sector are determined largely by the sulphur content of the fuel. SO_2 emissions factors for road vehicles are based on an average sulphur content in gasoline of 0.03 percent by weight and in diesel of 0.22 percent by weight.

Most of the particulates that are emitted from transportation sources come from the tires and brake linings of road vehicles. Particulates are also emitted in the exhaust from diesel engines.

The NO_x, CO, and VOC emissions factors depend on the type of emissions control equipment on the fleet, the temperature (season), and whether the vehicle-kilometres travelled (VkmT) are accumulated during cold start and warm-up of the engine (primarily urban driving) or

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[2] The main sources of SO_2 are coal-fired power plants and non-ferrous ore smelters.

when the engine is warmed up (primarily highway driving). Emissions factors were calculated using the MOBILE4C computer program. They are average annual values that take into account the emissions control equipment of the Ontario fleet, seasonal temperatures, and the split between urban and highway driving. Emissions factors are generally lower in the summer than the winter and lower during highway driving than during urban driving.

Carbon dioxide emissions factors depend on the carbon content of the fuel. CO_2 emissions factors are based on the assumption that all of the carbon emitted when the fuels are burned combines with oxygen in the atmosphere to become CO_2.

2.6 Projections of emissions

Emissions forecasts for CO_2 and SO_x in 1990, 1995, 2000, and 2005 were estimated from projected fuel use, since the carbon and sulphur content of the fuel determine emissions. VOCs, NO_x, CO and particulate emissions for these years were estimated based on projected vehicle kilometres travelled (VkmT), since emissions of these is largely determined by regulatory standards set on the basis of distance travelled. The baseline emission projections account for changes in the emissions factors for each forecast year which reflect new emissions standards and fleet turnover.

The emissions factors used in the forecasts are as follows:

- SO_2 emissions factors are held constant through to 2005 at the 1985 levels. SO_2 emissions factors are largely determined by the sulphur content of the fuel used. Environment Canada published its intention to regulate the sulphur content in diesel fuel under the Environmental Protection Act in the June 30, 1990 *Canada Gazette, Part I*. The regulation under consideration will limit the sulphur content of diesel fuel to 0.05 percent by weight, effective October 1, 1993. If the regulation is promulgated, the sulphur content of diesel fuel will fall substantially from its current average of 0.22 percent by weight, and SO_2 emissions factors for diesel engines will drop sharply. As a result, SO_2 emissions from transportation sources would decline by 40 to 45 percent from the baseline 2005 projection. Further reductions in SO_2 emissions will be achieved by measures that reduce the amount of fuel that is consumed.

  Particulate emissions factors are also kept constant over the forecast horizon at 1985 levels. Few changes are anticipated in the amounts of particulate emitted as a result of tire and brake lining wear. However, any reduction in the sulphur content of diesel fuel will result in a reduction in particulate emissions from diesel engines as well. In addition, increasingly stringent particulate standards for diesel-powered road vehicles are scheduled to come into effect between 1990 and 1994. The combination of limits on the sulphur content of diesel and stringent diesel particulate standards will greatly reduce any environmental damage that is caused by diesel particulate. Further reductions in

particulates will be achieved by measures that result in reductions in the number of VkmT by road vehicles or the amount of fuel consumed.

NO_x, CO and VOC emissions factors used in the forecasts for road vehicles were obtained from Environment Canada. They are the same emissions factors as those used for the forecasts in the *Federal/Provincial Management Plan for Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs)* (March, 1990). The emissions factors show substantial declines between 1985 and 2005. These declines are the result of more stringent emissions standards that came into effect in September, 1987 (i.e., for the 1988 model year) for passenger cars and light trucks and in 1990 for heavy duty trucks and buses. As more of the motor vehicles that were manufactured prior to the implementation dates of the new standards are retired from the active fleet, the fleet average emissions factors will decline. Further reductions in emissions of NO_x, CO and VOCs from road vehicles will be achieved by measures that reduce the number of VkmT and by more stringent emissions standards.

The NO_x, CO and VOCs emissions factors used in the forecasts for railroads, aircraft, and marine sectors are kept constant to 2005 at the 1985 levels.

CO_2 emissions factors used in the forecasts are held constant for all fuel types. Since CO_2 emissions factors are based on the carbon content of fuels, the only measures that are effective in reducing CO_2 emissions are those that result in a reduction in the amount of carbon-based fuels that are consumed.

The baseline forecasts do not include the effects of measures that are under consideration for implementation before 2005 but for which effective dates and the details have not been announced. Some of the measures excluded from the baseline include:

- more stringent emissions standards which are being considered by Transport Canada for the mid-1990's
- fuel economy standards like, for example, U.S. Corporate Average Fuel Economy standards
- motor vehicle inspection and maintenance programs.

Emissions production is usually calculated from the energy demand equation (1) above. All of the emissions of concern to this study, emitted from transportation sources, are directly proportional to either *Energy Consumption* or *Amount of Activity*:

$$\textit{Emissions Production} = \textit{Emissions/Unit of Energy} * \textit{Amount of Energy} \quad [2]$$

or

$$\textit{Emissions Production} = \textit{Emissions/Unit of Activity} * \textit{Amount of Activity} \quad [3]$$

The baseline emissions forecasts are summarized in Table 2-5.

Table 2-5
Baseline emissions quantities forecasts for Ontario's transportation sector (kt/a)

Emission Type	Year				
	1988	1990	1995	2000	2005
SO_2	33	34	38	42	47
NO_x	306	243	225	193	207
Particulate	38	41	46	52	57
CO	1 896	1 344	1 218	1 019	1 079
VOC	241	190	173	138	145
CO_2	42 281	44 034	48 283	51 208	54 712

2.7 Comparison of emission projections with other estimates

As a result of using lower base quantities during 1985 for diesel-powered road vehicles than those used by the MOE Air Resources Branch, the emissions quantities for the 1985 baseline are lower than the Air Resources Branch's. The baseline emissions forecasts are also lower than the Environment Canada forecasts in the *Federal/Provincial Management Plan for Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs)* (March, 1990). Environment Canada used even higher base quantities during 1985 for diesel-powered road vehicles than did the Air Resources Branch. Environment Canada's growth factors were also substantially higher than those used by the National Energy Board, or the MENY model.

The quantity of SO_2 emissions are shown as growing steadily. However, as described above, a relatively simple "technical fix"—limits on the sulphur content of diesel fuel—is under consideration and, if implemented, will result in a substantial reduction in SO_2 emissions. In any case transportation sources account for only about two to three percent of all SO_2 emissions.

Particulate emissions are also shown as increasing to 2005. However, measures to control the fraction of total particulates which are considered the greatest threat to the environment, those emitted by diesel-powered road vehicles, have been implemented. Neither SO_2 nor particulate emissions from transportation sources are expected to present serious problems in 2005.

NO_x, CO and VOC emissions are all shown as decreasing steadily until 2000 and then starting to increase by 2005. By the year 2000 virtually all of the motor vehicles manufactured prior to the effective dates of the latest emissions standards will have been retired from the active fleet and the fleet average emissions factors will have levelled off. Fuel consumption and its direct correlate, CO_2 emissions, are expected to grow steadily under the assumptions of the baseline forecasts. In the absence of more stringent emissions standards total NO_x, CO and VOC emissions will start to increase after 2000 with any increase in VkmT. With the exception of more stringent emissions standards, all of the measures aimed at reducing emissions will also result in less fuel consumption and *vice versa*. More stringent emissions standards will be included as a measure in all of the strategies, but the focus of the strategies will be on measures that reduce fuel consumption and CO_2 emissions. This approach will ensure that any strategies that are formulated to meet fuel consumption and CO_2 reduction goals will also result in maximum reductions of other emissions.

Table 2-6
Estimates of annual CO_2 emissions production in Ontario

Sector/Mode	CO_2 Emissions Production (kt/a)				
	1988	1990	1995	2000	2005
Auto	20,058	21,265	23,313	23,702	24,909
Truck	10,684	10,962	11,774	13,112	13,852
Airplane	4,244	4,348	5,006	5,394	6,070
Light truck	3,182	3,254	3,520	3,805	4,130
Rail	1,616	1,626	1,800	1,991	2,166
Marine	1,297	1,328	1,459	1,636	1,828
Other[a]	587	618	705	808	928
Bus	545	562	630	683	748
Streetcar & subways	0	0	0	0	0
GO-train	68	70	75	78	82
Total	42,281	44,034	48,283	51,208	54,712

[a] "Other" includes motorcycles, school buses and recreational vehicles.

3 Measures and actions for reducing energy use and emissions

Reducing the quantity of energy used in, or reducing the quantity of emissions released from Ontario's transportation systems can be accomplished in a wide variety of ways. To assist in the conceptualization and organisation of these ways, it is helpful to think of them in terms of

- *actions* and
- *policy or program measures.*

Actions are activities which result in reduced energy use or in emission reductions.

Policy or program measures are government initiatives aimed at encouraging taking actions which reduce energy use or emissions. An example will help clarify the distinction between actions and measures. "Driving fuel efficient automobiles, rather than inefficient ones" is an action that will reduce the amount of fuel burned; government may implement measures, like regulating new car fuel economy or imposing a fuel tax to encourage or require automobiles rated at less than, say, 7 L/100 km, and to prohibit or discourage the purchase or use of automobiles requiring in excess of 7 L/100 km.

The target for provincial policy or program measures varies, depending on the desired action. For example, efforts to reduce fuel use by automobiles might use a regulatory measure to require that the average of all cars sold meets a certain target; expansion of a public transit system might be encouraged by increasing grants to municipalities for transit development; improving truck fuel efficiency might be promoted through education and training programs on the importance of driving habits, and potential economic savings associated with the use of air deflectors.

3.1 Available policy options

Governments can undertake three types of policy or program measures to encourage actions to reduce energy use or emissions:

- increase information on choices available, with the aim of encouraging people to make the choice that achieves the policy objective
- alter the incentives for making choices
- change the range of choices available.

Examples of each of these are presented in Table 3-1.[3]

Table 3-1
Program or policy measures—levers for encouraging actions

Type of policy or program measure	Effect of measure	Example measures
Attitudinal/informational measures to increase information on the choices available	Increase awareness of available choices	Publicize opportunities for car pooling
	Provide information on the implications of available choices	Report on the greenhouse impact of automobile travel versus transit
Economic and related measures which alter incentives for making choices	Decrease costs	Provide rebates on vehicles using alternative fuels
	Increase costs	Implement a fuel tax based on CO_2 released
Regulation and related measures which change the range of choices	Increase the choices available	Require that communities provide public transit service
	Decrease the choices available	Eliminate automobiles with high emission levels

[3] A detailed list of potential actions and measures is appended (Appendix A).

3.2 Evaluating measures and actions

Actions, and measures that lead to actions, can be evaluated by assessing them against four factors:

- their potential to reduce energy use or emissions
- the ease of their implementation
- distributional considerations
- their effectiveness and the reasons for them being effective.

3.2.1 Potential energy savings or emissions reductions

A key consideration in evaluating measures or actions must be how much energy they can be expected to save, or the extent to which they can reduce emissions. Assessing the potential of an action requires a clear understanding of what the objective is. This may incorporate very specific components, beyond just reducing the total number of gigajoules used in transportation or the grams of emissions produced by the transportation sector. These components may include:

- the time frame over which energy reductions are to be achieved
- the time frame over which emissions reductions are to be achieved
- the specific types of transportation fuels that are to be reduced
- the specific types of emissions that are to be reduced
- the temporal or geographic distribution of reductions, since "problems" may be restricted to certain times and places particularly for some emissions (e.g. NO_x and VOC emissions are of particular concern during the summer in southern Ontario).

In principle, determining which of these (or other) considerations is relevant will depend on the specific objectives to be achieved.

For the purposes of this study, the focus is on measures that have an effect over the next fifteen years, and which affect primarily CO_2 emissions. The focus on CO_2 reflects the fact that a regulatory agenda has already been set out that will significantly reduce emissions of most of the other compounds considered. In contrast, reducing greenhouse gases, including CO_2, has only been discussed. Since CO_2 releases are highly correlated with energy use, particularly in the petroleum dependent transportation sector, the concern with reducing CO_2

is *almost* synonymous with reducing energy use. Further since the greenhouse effect is a global problem, and energy supply is a provincial one, geographic or temporal variations are of secondary importance.

3.2.2 Ease of implementation

Determinants of the ease of implementation might be thought of as the same factors that affect the "uptake" or "penetration" of the action. The purpose of measures is to modify those factors so as to increase the uptake.

Among the components that will affect the ease of implementation are:

- the cost of the action—it is relatively easier for governments to promote actions with lower costs than ones with higher cost.

- the cost of the measure—how much will it cost to implement the measure (as distinct from the action it is intended to bring about)?

- jurisdictional considerations—the ability to introduce a measure to promote particular actions will be affected by jurisdictional responsibility. Legislation assigns specific responsibilities and powers to each level of government, and some measures will be more or less available to any particular level of government.

- inertia—some measures will have considerable inertia to overcome before they can be introduced. In some cases this will relate to the time to introduce the change (e.g. to turn over a fleet, or to change urban design). In others it will relate to reluctance to turn away from standard procedures or accustomed lifestyles.

- social response—measures which have widespread support, or which are responding to a problem which is widely recognized as serious, are more likely to be easy to implement.

The total effect of a measure or program may be thought of as the product of the technical potential and the ease of implementation. It is the product of these two factors that will determine the attractiveness of the measures.

3.2.3 Distributional considerations

In addition to *what* effect a measure will have, governments will also be concerned about *who* the measure affects: how the effects are distributed. This relates to other objectives of government, particularly the desire to be fair and equitable.

Measures will inevitably affect some sub-set of society more than others. Governments will inevitably need to assess measures to determine:

- is the sub-group affected most the one contributing most to the problem the measure is trying to address?

- is the benefit of the effect of the measure's adoption likely to exceed the costs borne but the affected sub-group, and if so, is the extra burden on the sub-group a reasonable one, or are there types of compensation that can be used to offset this burden?

- by affecting a particular sub-group, does the implementation of the measure interfere with other social goals, like income redistribution, or regional development?

For example, studies in Canada have shown that low-income families spend a higher proportion of their income on direct energy purchases than higher income families and they tend to be the least informed about energy efficiency issues and least able to make investments in increased efficiency (Robinson, 1989).

3.2.4 Effectiveness—how and why

Finally, consideration must be given to the reasons why measures are required at all; why the actions are not being adopted spontaneously, if they are worthy of adoption, and what these reasons say about the types of measures that are likely to be effective: information measures, economic measures, or regulatory measures.

Information measures

In Table 3-1, it was noted that information measures can provide information about available choices, or about the implications of choices. It is obvious that these kinds of measures are only going to be effective where consumers do not *have* accurate information (and the information provided by the measure is considered by the recipients to be accurate), or where their preferences can be swayed by moral suasion.

In addition, information measures will have a very important role to play in support of other economic or regulatory measures which change the decision environment.

Economic measures

Economic disincentives (like fuel taxes, or gas guzzler taxes) serve to change the choice environment to favour (or increase the favour of) some choices over others. To the extent that users of transportation are sensitive to prices in their choice of mode or technology, and behave in an economically rational manner, economic measures will lead to changes in energy using patterns (and hence emissions). Economic disincentives are particularly appropriate where there may be social or environmental costs that are not recognized by the market (externalities). For example, a tax could be added to fuels to reflect their relative contribution to global warming, thus "internalizing" (some) costs associated with possible climate change.

Economic incentives may be used to affect the relative attractiveness of choices, by making some choices cheaper than other ones, or to overcome certain market imperfections. For example, considerable evidence suggests that energy consumers use very high implicit discount rates, from several to ten times market rates (Robinson,1989). Of course these market rates are themselves often significantly higher than the social discount rate. The implication of this is that consumers may not spontaneously adopt energy saving measures that are economically attractive, both to the consumer and to society as a whole; additional incentives may be necessary to capture the benefits that are possible.

Similarly, some energy users (or providers of transportation services) may not have ready access to credit to invest in more efficient energy equipment: customers may not feel they can afford a new, more efficient vehicle; municipalities may feel unable to expand their transit operations.

Regulatory measures

Finally, regulatory measures may be used to broaden the range of choices available, for example by requiring that public transit service be provided, or to constrain the range of choice, for example—in the case of automobiles—to new vehicles meeting certain efficiency criteria.

Regulatory measures have been used with particular success in the transportation sector, where fuel efficiency standards have been set for automobiles. Standards are a relatively easy and reliable method of increasing energy efficiency, however, they are difficult to design in a way that gains acceptance from all interested parties (Robinson,1989).

Regulatory measures may be used to overcome several market failures, including the high implicit interest rates mentioned above, and the existence of split incentives.

Other regulatory measures, ranging from restricting parking and mandating transit tie-ins for new developments to gasoline rationing can all play a role depending on the extent of control over transportation patterns required and the urgency of the problem.

Integrated programs

The most effective strategies, or programs of measures are likely to be those that draw on all three types of measures discussed above. Such integrated strategies provide the greatest range of tools, and measures can be grouped in ways that are mutually supportive. For example, information programs can supplement subsidy programs, incentive programs can be structured to enhance and make more tolerable regulatory measures.

3.3 Literature review and summary

An extensive review of the literature dealing with potentials for energy savings was undertaken. The purpose of the review was to identify specific actions or measures that might have an effect on CO_2 emissions, either through fuel switching or reductions in energy demand. As part of this review, specific quantitative measures of the potential for energy savings were sought.[4]

The literature typically assesses the potential of an action or measure as a percentage of the baseline use in the sector or specific application affected by the action or measure. In other cases, the potential measured in this way was estimated. The potential impact on overall energy use in the transportation sector was estimated by multiplying the potential savings for the specific application by the share of total projected transportation energy use attributable to the specific application.

3.4 Grouping of actions and measures

Many of the items proposed in the literature are very specific or result in very small energy savings on their own. These are grouped into more general or broad categories which are more appropriate for use in considering their potential from a broadbrush policy perspective. Thus all the actions which relate to improving the fuel efficiency of automobiles are considered together. Thus measures, like fuel economy standards, are assessed without referring to the specific actions (e.g. specific engine modifications) that are adopted in response to the measures.

By grouping the measures, it is possible to consider virtually all of the measures or actions, though at a more general level of detail. Only two groups of measures are not considered: measures relating to improving the fuel efficiency of aircraft, and rail electrification. The new aircraft that are joining the fleet now are much more efficient than existing aircraft (a 767 uses only about two thirds as much fuel per passenger kilometre as a 737), and fuel efficiency

[4] The results of the review and summary of the literature are presented in Appendix A.

will be determined by the fleet turnover rate. There is little that Ontario can do to affect aircraft fuel economy. Electrification of rail freight transport has often been proposed as an energy saving measures, with savings as high as 68.4 per cent being cited (DPA, 1989). However, this too is largely out of Ontario's jurisdiction. Further, because rail is already quite efficient, and is losing ground to truck transport, total savings from electrification are quite modest (about 2.5 per cent of 2005 projected energy use).

The result of the grouping is the measures shown in Table 3-2. Table 3-2 also indicates how the effects of these measures are modelled, whether by affecting the demand for transportation, the efficiency of transport vehicles, or the unit emissions rate.

The effects of each measure on energy and emissions are analyzed by evaluating the fuel consumption, transportation demand, and emissions rates effects. Each measure is assumed to reduce one of these components by a percentage (determined through the literature study).

MENY's model provides energy demand and emissions production by mode and year. Since most measures usually have mode- and year-specific reduction levels, the high level of disaggregation enables modelling of effects on this basis.[5]

3.5 Matching measures and actions to strategies

Matching measures and actions to strategies is done based on a consideration of the effects of the measures, and the objectives of the strategies. The objectives of a strategy may be expressed in terms of the time-frame over which it is to occur, the types of measures to be used to achieve the objective (e.g. regulatory or economic measures), and the costs or lifestyle impacts that are acceptable. The next chapter considers various strategies, and the measures that are appropriate for each.

[5] Appendix C describes the measures considered, each measure's assumed effects on consumption, demand or emissions rates and, where available, cost information.

Table 3-2
Measures remaining after grouping actions and measures.

Economic measures	Effect of measure for modelling purposes		
	Transportation demand	Vehicle efficiency	Unit emissions rate
Carbon tax	•	•	
Gas guzzler tax		•	
Transit subsidies	•		
Land use management	•		
Communications incentives	•		
Regulatory measures			
Vehicle efficiency standards		•	
Urban density increases	•		
Urban traffic management		•	
Inspection and maintenance		•	•
Demand reduction	•		

4 Strategies for reducing energy use and emissions

4.1 Actions and measures

Table 4-1 presents the measures considered in the study associated with the appropriate action. The actions listed in Table 4-1 are those used to achieve the scenario objectives. The measures are grouped into three types:

- information and education programs which educate and inform the public regarding the efficient use of energy and the potential economic and environmental benefits;
- economic incentives and disincentives which alter the energy use habits of society by either rewarding efficient energy use or imposing higher costs on inefficient energy use; and
- Regulatory and related measures which impose required energy efficiency or restrict energy use to achieve policy objectives.

For this study economic and regulatory measures are examined and information and education programs are assumed concurrent.

Table 4-1
Measures associated with selected actions

Action	Information & education programs	Economic incentives & disincentives	Regulatory and related measures
Improve automobile technology	• Public education concerning greenhouse and related effects, the importance of energy conservation and the importance of vehicle selection in helping to solve the problem. • Labelling of energy and emissions performance for all vehicles.	• Licence/tax surcharge on vehicles based on energy performance, e.g. extend gas guzzler tax to other vehicle purchases, based on energy and emissions. • Rebates for early trade-in of older vehicles. • Increased tax on fuels/carbon taxes.	• Mandatory efficiency levels for all vehicles, eg. new CAFE standards.
Improve truck technology	• Public education on the availability and effectiveness of energy saving technologies, and their economic and environmental benefits	• Licence/tax surcharge on vehicles based on energy performance, or use of energy saving technologies, e.g. penalties for vehicles not using air deflectors and gas guzzler taxes. • increase tax on fuels/carbon taxes.	• Mandate efficiency levels for all vehicles, by class.
Encourage urban automobile shift to transit	• Public education concerning greenhouse and related effects, the importance of energy conservation and the importance of mode selection in helping to solve the problem.	• Incentives or requirements for businesses to assist transit by locating near stations. Communications equipment to improve service. • Private investment in transit. • Extend tax exemptions to energy-efficient practices (employer economic incentives to employees for taking transit, e.g. transit passes as an employee benefit) • Increased subsidy to transit to improve service, while maintaining or lowering fares • Capital investment in transit expansion • Road fees (e.g. toll roads)	• mandate transit efficiency and convenience improvements, park and ride, express service, service expansion, reserved lanes or exclusive ROWs for transit vehicles, fare incentives, shelters, etc. • require transit integration into new developments • restrict private vehicle access through parking controls, access limitations or other means • simplify regulatory approval of transit developments through exemptions or streamlining of approvals process.

Table 4-1
Measures associated with selected actions

Action	Information & education programs	Economic incentives & disincentives	Regulatory and related measures
Change urban land-use management/zoning	• Provide information on the environmental benefits of higher density development, and provide demonstrations showing that higher density and a high quality of life are compatible.	• Set property taxes to include the environmental costs associated with the surrounding land use patterns, e.g. higher for low density development, and lower for high density development. • Provide economic incentives for integrating development with public transit.	• Set minimum density levels that will reduce the need for automobile travel by making walking, bicycling and public transit viable alternatives. • Encourage mixed use developments. • In new developments, require that ROWs be set aside for transit and bicycles.
Improve urban automobile traffic management	• Provide information on benefits of off-peak travel. • Provide real-time information on traffic conditions and alternate routings.	• Institute road pricing.	• Remove constraints and encourage HOV lanes, traffic signal coordination, controlled access to freeways, etc. • One way streets.
Improve automobile maintenance	• Provide information on the benefits of improved vehicle maintenance, and on actions that vehicle owners can take to ensure their vehicles are operating efficiently. • Provide clinics to test vehicle emissions and fuel efficiency.	• Incentives/rebates for good maintenance records.	• Require regular vehicle inspection and action where poor performance is detected.
Reduce automobile travel	• Advise on trip planning	• Tax on fuels/carbon taxes. • Increased subsidy to transit to improve service, while maintaining or lowering fares • Road fees (e.g. toll roads) • Capital investment in transit expansion	• Restriction on how much each person can drive (rationing). • Restrictions on where one can drive (or park). • Restrictions on when one can drive.
Substitute communications for transportation	• Provide information and education on the benefits of the use of communications and on actions that people can take to better utilize communications systems efficiently.	• Tax on fuels. • Provide for accelerated depreciation of communications equipment, and reduce or eliminate taxes on communications services. • Subsidize home shopping/work at home.	• Change municipal by-laws to permit non-disruptive work in residential areas. • Require the use of communications in government business transactions.

4.2 Scenarios and objectives

Table 4-2 presents the base case and the four scenarios examined. Three different strategies are applied to each scenario. The first strategy for each scenario uses only economic instruments to achieve the scenario objectives. The second uses only regulatory instruments, and the third uses a combination of both economic and regulatory instruments to achieve the strategy's objectives. Each strategy uses a combination of measures to achieve the scenario objective.

The base case consists of the forecasted energy use, fuel efficiency, demand for transportation and emissions from the Ontario transportation sector beginning in 1988 and every five years from 1990 to 2005.

4.2.1 Actions economically attractive to society

A total of four scenarios were developed. Actions economically attractive to society are those actions which improve fuel efficiency and reduce emissions from the transportation sector at a net economic benefit to society. For the purposes of this study it is assumed that the measures selected for this scenario do not impose lifestyle changes. The measures considered for the three strategies used to achieve the scenario objective include:

- improving passenger vehicle fuel efficiency by 20 per cent and truck fuel efficiency by 10 per cent through the imposition of tougher CAFE standards;
- a moderate increase in the public transit share to 13 per cent;
- implementation of traffic management measures improving urban fuel efficiency 5 per cent;
- improved automobile and truck inspection and maintenance resulting in a 5 per cent increase in fuel efficiency; and
- incentives for the greater use of communications reducing private and public passenger vehicle demand by 5 per cent.

Table 4-2
General description of scenarios and strategies

Scenario	Description	Strategies		
		Reliance on economic measures	**Use of a mix of economic and regulatory measures**	**Reliance on regulatory measures**
Base case	Consideration of expected energy use and emissions based on proposed fuel efficiency and emissions standards to 2005.	• No new measures	• No new measures	• No new measures
Actions economically attractive to society in their own right by 2005	Adoption of those actions which are economically attractive to society (a social benefit) regardless of energy use or emissions.	• Incentives (including subsidies) and disincentives	• Combinations of economic and regulatory measures	• CAFE standards to where marginal costs are no longer decreasing. • Inspection and maintenance programs. • Implement HOV, fleet and traffic management programs. • Restrictions on auto use in urban areas
Zero per cent increase in carbon dioxide emissions by 2000 relative to 1988, effects considered to 2005	Achieve no increase in CO_2 emissions relative to 1988 by 2000, effects considered in 2005 for comparison with other 2005 scenarios.	• Economic measures from Table 4-1	• Combinations of economic and regulatory measures	• Regulatory measures from Table 4-1
Twenty per cent reduction in carbon dioxide emissions by 2005 relative to 1988 at the least cost	Achieve the global target of a 20 per cent reduction in 1988 CO_2 emissions by 2005 at the least cost to society.	• Economic measures from Table 4-1 (applied more vigorously)	• Combinations of economic and regulatory measures	• Regulatory measures from Table 4-1 (applied more vigorously)
Twenty per cent reduction in carbon dioxide emissions by 2005 relative to 1988, best position for achieving a 60 per cent reduction in the future	Achieve the global target of a 20 per cent reduction in 1988 CO_2 emissions by 2005 while ensuring that further CO_2 emission reductions can be made as part of the global objective of stabilizing atmospheric CO_2 concentrations.	• Economic measures from Table 4-1 (applied even more vigorously)	• Combinations of economic and regulatory measures	• Regulatory measures from Table 4-1 (applied even more vigorously)

4.2.2 Zero growth in carbon dioxide emissions relative to 1988 by 2000.

The effects of this scenario were examined to 2005. The primary objective of this scenario is to select measures which achieve 1988 carbon dioxide emission levels by 2000. The cost of a measure is considered only when a choice between measures could be made. In such instances, if both measures can achieve the objective the least cost measure is selected. The measures considered include:

- improve passenger vehicle fuel efficiency by 26 per cent and truck fuel efficiency by 13 per cent through the imposition of tougher CAFE standards;
- a realistic increase in the public transit share to 16 per cent;
- implementation of urban traffic management measures improving urban fuel efficiency 5 per;
- improved automobile and truck inspection and maintenance resulting in a 5 per cent increase in fuel efficiency;
- restrictions on passenger motor vehicle use reducing travel demand 5 per cent; and
- imposition of a carbon tax resulting in a 16 per cent improvement in fuel efficiency and a 3 per cent reduction in travel demand.

4.2.3 Twenty per cent reduction in carbon dioxide emissions from 1988 levels by 2005 at the least cost

The third scenario is the achievement of the objective of a 20 per cent reduction in carbon dioxide emissions from 1988 levels by 2005 at the least cost. The measures selected for each strategy to achieve this scenario are those measures which in combination achieve the objective at the lowest cost to society. The measures considered include:

- improving passenger vehicle fuel efficiency by 32 per cent and truck fuel efficiency by 14 per cent through the imposition of tougher CAFE standards;
- an optimistic increase in the public transit share to 22 per cent;
- implementation of urban traffic management measures improving urban fuel efficiency 5 per cent;
- improved automobile and truck inspection and maintenance resulting in a 5 per cent increase in fuel efficiency;
- better urban land use planning reducing urban travel demand by 10 per cent;
- restrictions on passenger motor vehicle use reducing travel demand from between 20 and 30 per cent; and
- imposition of a carbon tax resulting in a 38 per cent improvement in fuel efficiency and a 5 per cent reduction in travel demand.

4.2.4 Twenty per cent reduction in carbon dioxide emissions by 2005 relative to 1988, best position for achieving a 60 per cent reduction in the future

The fourth scenario is similar to the third scenario except that cost is not considered. A parallel objective of this scenario is the positioning of the transportation sector to ensure that the reductions in carbon dioxide emissions necessary to stabilize atmospheric carbon dioxide concentration are achievable. The measures considered include:

- improving passenger vehicle fuel efficiency by 32 per cent and truck fuel efficiency by 14 per cent through the imposition of tougher CAFE standards;
- an optimistic increase in the public transit share to 22 per cent;
- implementation of comprehensive urban traffic management measures improving urban fuel efficiency 10 per cent;
- improved automobile and truck inspection and maintenance resulting in a 5 per cent increase in fuel efficiency;
- large changes in urban land use planning reducing urban travel demand by 15 per cent;
- restrictions on passenger motor vehicle use reducing travel demand 20 per cent; and

- imposition of a carbon tax resulting in a 38 per cent improvement in fuel efficiency and a 10 per cent reduction in travel demand.

4.3 Strategies considered for each scenario

A total of 12 strategies, three for each scenario, were developed. Each strategy contains those measures which best achieve the scenario objective. Table 4-3 presents the measures used by strategy and scenario. A total of 21 measures are selected based on two different actions: improve motor vehicle efficiency; and reduce passenger vehicle travel. The 21 measures are a breakdown of nine measures based on the degree of effectiveness of each measure. For example, urban land use management reduces urban private and public vehicle travel demand 10 or 15 per cent depending on the extent which the measure is adopted. The first 12 measures in Table 4-3 utilize economic instruments and the remaining 9 measures are regulatory instruments.

A complete description of each measure is found in Appendix C.

4.4 Results

Results for each strategy by scenario are presented in Table 4-4. For each strategy a combination of economic or regulatory, or both, measures are selected which achieve the scenario objective. The differences in the effectiveness of each strategy in achieving a scenario objective reflects the different mix of measures used to achieve the scenario objective and does not indicate the superiority of one strategy over another.

4.4.1 Actions economically attractive to society

The actions economically attractive to society are those which provide a social economic benefit without imposing lifestyle changes. As such, although other more ambitious measures which are economically attractive are available the measures selected for this scenario impose minimal change on society.

Table 4-3
Measures by strategy a nd scenario

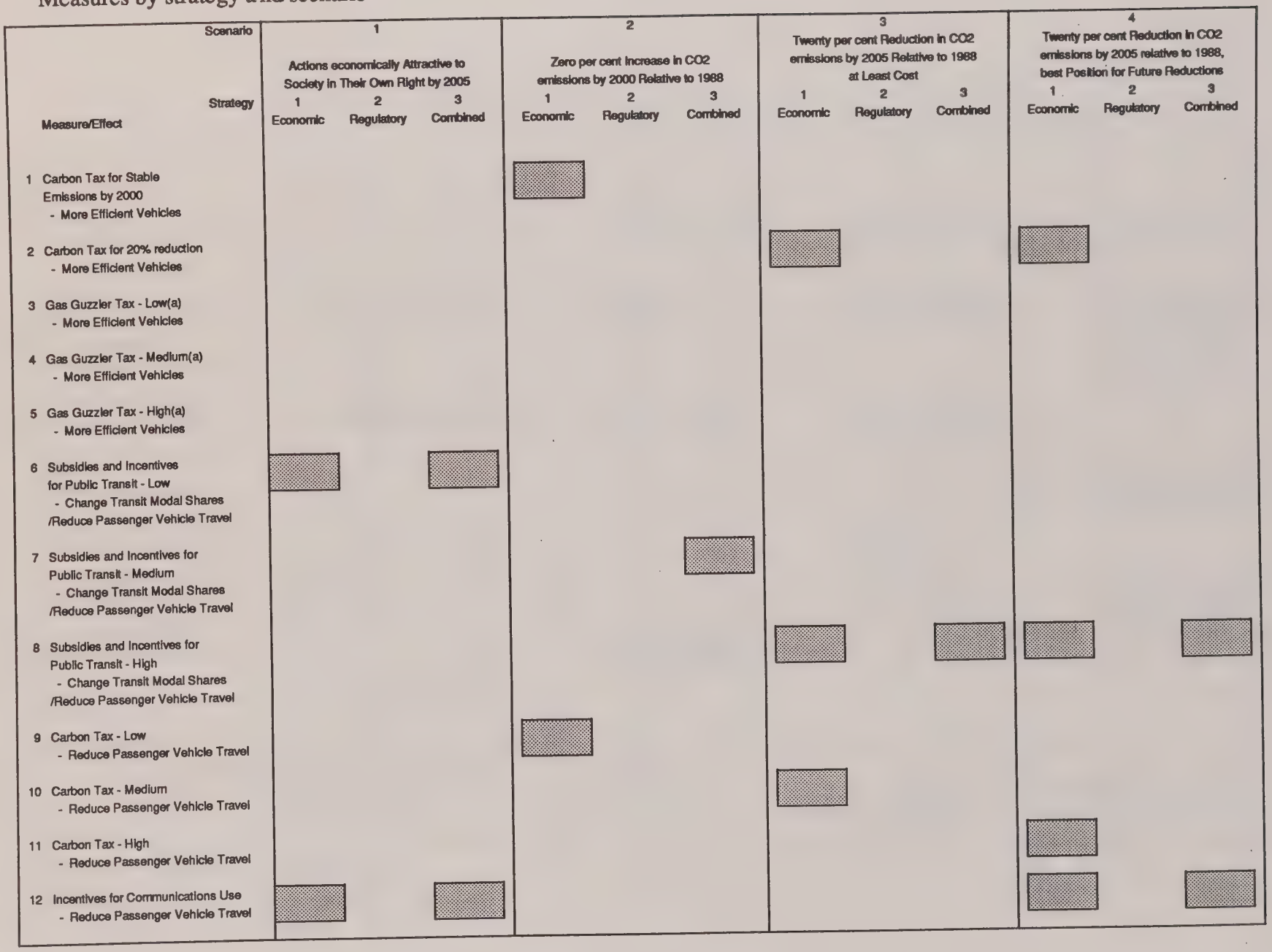
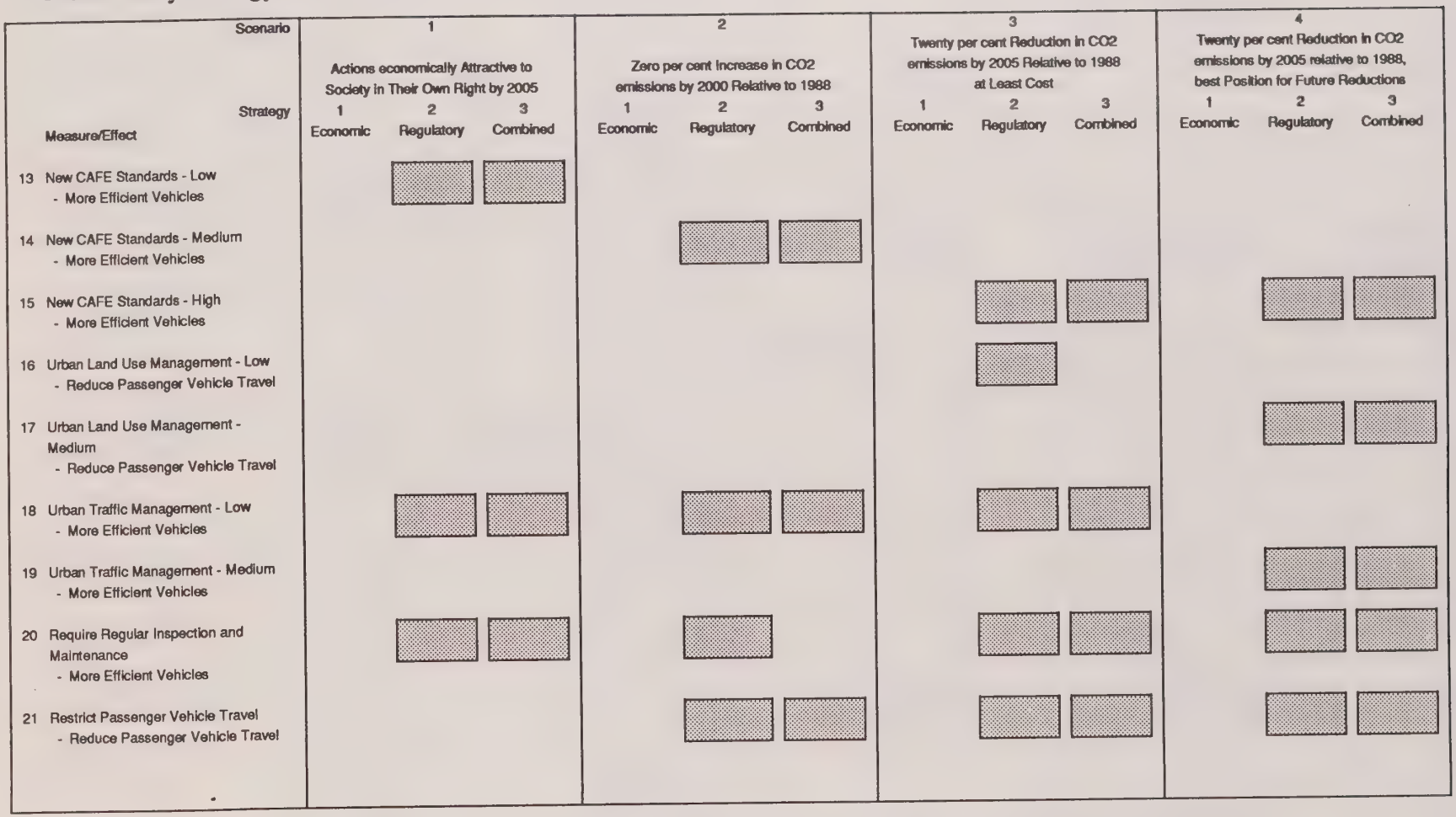


Table 4-3

Measures by strategy a nd scenario



Note: (a) The gas guzzler tax was analysed but not included in the strategy analysis. If a gas guzzler tax was included its effect would be identical to new CAFE standards.

Economic measures

The economic measures used in this strategy and their effect are as follows:

- subsidies and incentives for public transit leading to a moderate increase of the transit share of urban transportation to 13 per cent for the province and a 5 per cent reduction in urban travel demand; and

- incentives for the use of communications rather than transportation resulting in a 5 per cent decrease in urban and inter-city travel demand.

The estimated energy savings and emissions reduction are small using these economic measures. Energy use will increase by 141 Pj/a from 1988 and carbon dioxide emissions will increase by about 10 million t/a.

Regulatory measures

The regulatory measures used in this strategy and their effect are as follows:

- new CAFE standards for private motor vehicles and trucks resulting in a 20 per cent reduction in passenger vehicle fuel consumption and 10 per cent reduction in truck fuel consumption by 2005;

- urban traffic management measures resulting in a 5 per cent reduction in urban private and public vehicle fuel consumption; and

- regular inspection and maintenance of passenger vehicles resulting in a 5 per cent reduction in fuel consumption.

Energy use is estimated to increase 34 PJ/a from 1988 resulting in a 2 million t/a increase in carbon dioxide emissions from 1988 levels using regulatory measures. The regulatory strategy results in no change from base case emissions levels for particulate matter, VOCs, nitrogen oxides and carbon monoxide since the regulatory measures used are not expected to effect the vehicles kilometres travelled from which emissions levels for these contaminants is estimated.

Economic and regulatory measures

The economic and regulatory measures used in this strategy and their effect are as follows:

- subsidies and incentives for public transit leading to a moderate increase of the transit share of urban transportation to 13 per cent for the province and a 5 per cent reduction in urban travel demand;

- incentives for the use of communications rather than transportation resulting in a 5 per cent decrease in urban and inter-city travel demand;

- new CAFE standards for private motor vehicles and trucks resulting in a 20 per cent reduction in passenger vehicle fuel consumption and 10 per cent reduction in truck fuel consumption by 2005;

- urban traffic management measures resulting in a 5 per cent reduction in urban private and public vehicle fuel consumption; and

- regular inspection and maintenance of passenger vehicles resulting in a 5 per cent reduction in fuel consumption.

Energy use is estimated to increase by about 4 PJ/a resulting in an overall increase in carbon dioxide emissions of about 500 thousand t/a from 1988 levels using a combination of economic and regulatory measures. The adoption of these measures would also achieve the second scenario objective of a zero per cent increase in carbon dioxide emissions by 2000 relative to 1988.

4.4.2 Zero per cent increase in carbon dioxide emissions by 2000 relative to 1988

The measures selected to achieve a zero per cent increase in carbon dioxide emissions by 2000 relative to 1988 differ from those which are economically attractive in the extent to which measures are implemented.

Economic measures

A single economic measure is used in this strategy:

- carbon taxes which result in an 18 per cent reduction in fuel consumption and a 3 per cent reduction in travel demand by 2000.

The estimated energy use and emissions achieve the scenario objective by 2000. The estimated energy use and carbon dioxide emissions reduction in 2005 increases from 2000 to above 1988 levels by 32 PJ/a and 2 million t/a of carbon dioxide.

Regulatory measures

The regulatory measures used in this strategy and their effect are as follows:

- new CAFE standards for private motor vehicles and trucks resulting in a 26 per cent reduction in passenger vehicle fuel consumption and 13 per cent reduction in truck fuel consumption by 2000;

- urban traffic management measures resulting in a 5 per cent reduction in urban private and public vehicle fuel consumption;

- regular inspection and maintenance of passenger vehicles resulting in a 5 per cent reduction in fuel consumption; and

- restrictions on passenger vehicle travel resulting in a 5 per cent reduction in passenger vehicle travel.

The estimated energy savings and emissions reductions achieve the scenario objective by 2000 and maintains energy use and carbon dioxide emissions at 1988 levels through to 2005. By 2005 energy use is estimated to increase by 11 PJ/a resulting in a 600 thousand t/a increase in carbon dioxide from 1988 levels.

Economic and regulatory measures

The economic and regulatory measures used in this strategy and their effect are as follows:

- subsidies and incentives for public transit leading to an increase to 16 per cent of urban transportation provided by transit modes for the province and an 8 per cent reduction in urban travel demand;

- new CAFE standards for private motor vehicles and trucks resulting in a 26 per cent reduction in passenger vehicle fuel consumption and 13 per cent reduction in truck fuel consumption by 2000;

- urban traffic management measures resulting in a 5 per cent reduction in urban private and public vehicle fuel consumption;

- restrictions on passenger vehicle travel resulting in a 5 per cent reduction in passenger vehicle travel.

The estimated energy savings and emissions reductions achieve the scenario objective by 2000 and maintains energy use and carbon dioxide emissions at 1988 levels through to 2005. By 2005 energy use is estimated to increase by 3 PJ/a resulting in a negligible increase in carbon dioxide from 1988 levels.

4.4.3 Twenty per cent reduction in 1988 carbon dioxide emissions by 2005

The results by strategy to achieve a 20 per cent reduction in carbon dioxide emissions by 2005 relative to 1988, at least cost, are presented below.

Economic measures

A combination of two economic measures are used in this strategy:

- carbon taxes which result in a 38 per cent reduction in fuel consumption and a 5 per cent reduction in travel demand by 2000; and

- subsidies and incentives for public transit leading to a 22 per cent transit mode share for the province and a 14 per cent reduction in urban travel demand.

The estimated energy savings and emissions reductions achieve the scenario objective for 2005 of a 20 per cent reduction of 1988 carbon dioxide emission levels. It is estimated that about 145 PJ/a of energy is saved reducing carbon dioxide emissions by about 9 million t/a from 1988 levels.

Regulatory measures

The regulatory measures used in this strategy and their effect are as follows:

- new CAFE standards for private motor vehicles and trucks resulting in a 32 per cent reduction in passenger vehicle fuel consumption and 14 per cent reduction in truck fuel consumption by 2000;

- urban land use management measures resulting in a 10 per cent reduction in urban travel demand;

- urban traffic management measures resulting in a 5 per cent reduction in urban private and public vehicle fuel consumption;

- regular inspection and maintenance of passenger vehicles resulting in a 5 per cent reduction in fuel consumption; and

- restrictions on passenger vehicle travel resulting in a 30 per cent reduction in passenger vehicle travel.

The scenario objective was achievable only through restricting passenger vehicle travel by 30 per cent which exceeds the 5 per cent restriction on passenger vehicle travel estimated as attainable without imposing significant lifestyle changes. The estimated energy savings and emissions reduction with the increased restriction on passenger travel achieves the scenario objective for 2005. The amount of energy saved is about 127 PJ/a, reducing carbon dioxide emissions by about 9 million t/a from 1988 levels.

Economic and regulatory measures

The economic and regulatory measures used in this strategy and their effect are as follows:

- subsidies and incentives for public transit leading to a 22 per cent transit mode share for the province and a 14 per cent reduction in urban travel demand;

- new CAFE standards for private motor vehicles and trucks resulting in a 32 per cent reduction in passenger vehicle fuel consumption and 14 per cent reduction in truck fuel consumption by 2000;

- urban traffic management measures resulting in a 5 per cent reduction in urban private and public vehicle fuel consumption;

- regular inspection and maintenance of passenger vehicles resulting in a 5 per cent reduction in fuel consumption; and

- restrictions on passenger vehicle travel resulting in a 20 per cent reduction in passenger vehicle travel.

The scenario objective was achieved through restricting passenger vehicle travel by 20 per cent which exceeds the 5 per cent restriction on passenger vehicle travel estimated as attainable without imposing significant lifestyle changes. The strategy reduces carbon dioxide emissions by about 8 million t/a from 1988 levels. An estimated 292 PJ/a of energy is saved from 1988 base year energy use.

4.4.4 Twenty per cent reduction in 1988 carbon dioxide emissions by 2005, best position for achieving a 60 per cent reduction in the future

The results by strategy to achieve a 20 per cent reduction in carbon dioxide emissions by 2005 relative to 1988, best position for achieving a 60 per cent reduction in the future, are presented below.

Economic measures

A total of three economic measures are used in this strategy:

- carbon taxes which result in a 38 per cent reduction in fuel consumption and a 5 per cent reduction in travel demand by 2000; and
- subsidies and incentives for public transit leading to a 22 per cent transit mode share for the province and a 14 per cent reduction in urban travel demand.
- incentives for the use of communications rather than transportation resulting in a 10 per cent decrease in urban and inter-city travel demand;

The estimated energy savings and emissions reductions achieve the scenario objective for 2005. It is estimated that about 171 PJ/a of energy is saved reducing carbon dioxide emissions by about 12 million t/a from 1988 base year estimates.

Regulatory measures

The regulatory measures used in this strategy and their effect are as follows:

- new CAFE standards for private motor vehicles and trucks resulting in a 32 per cent reduction in passenger vehicle fuel consumption and 14 per cent reduction in truck fuel consumption by 2000;
- urban land use management measures resulting in a 15 per cent reduction in urban travel demand;
- urban traffic management measures resulting in a 10 per cent reduction in urban private and public vehicle fuel consumption;
- regular inspection and maintenance of passenger vehicles resulting in a 5 per cent reduction in fuel consumption; and

- restrictions on passenger vehicle travel resulting in a 20 per cent reduction in passenger vehicle travel.

The scenario objective was achievable only through restricting passenger vehicle travel by 20 per cent, exceeding the 5 per cent restriction on passenger vehicle travel estimated as attainable without imposing significant lifestyle changes. The estimated energy savings and emissions reductions, with the increased restriction on passenger travel, achieves the scenario objective for 2005. The restriction on passenger vehicle travel is less than the 30 per cent included in Section 4.4.3 because of the energy savings resulting from better land use management and urban traffic control. These measures were not used in Section 4.4.3. The amount of energy saved from this regulatory strategy is 119 PJ/a, reducing carbon dioxide emissions by 8 million t/a from 1988 levels.

Economic and regulatory measures

The economic and regulatory measures used in this strategy and their effect are as follows:

- subsidies and incentives for public transit leading to a 22 per cent transit mode share for the province and a 14 per cent reduction in urban travel demand;

- incentives for the use of communications rather than transportation resulting in a 10 per cent decrease in urban and inter-city travel demand;

- new CAFE standards for private motor vehicles and trucks resulting in a 32 per cent reduction in passenger vehicle fuel consumption and 14 per cent reduction in truck fuel consumption by 2000;

- urban land use management measures resulting in a 15 per cent reduction in urban travel demand;

- urban traffic management measures resulting in a 10 per cent reduction in urban private and public vehicle fuel consumption;

- regular inspection and maintenance of passenger vehicles resulting in a 5 per cent reduction in fuel consumption; and

- restrictions on passenger vehicle travel resulting in a 20 per cent reduction in passenger vehicle travel.

The scenario objective was achievable through restricting passenger vehicle travel by 20 per cent. The strategy reduces carbon dioxide emissions by about 10 million t/a from 1988 base case estimates. An estimated 147 PJ/a of energy is saved from 1988 levels.

4.4.5 Summary of results

The effectiveness of the measures by type of scenario is presented in Figure 1 to Figure 4. For actions that are economically attractive to society, combined economic and regulatory measures are most effective (Figure 1). All three types of measures are effective in achieving a zero per cent increase in carbon dioxide emissions by 2000 relative to 1988 (Figure 2). However, regulatory measures appear more effective in maintaining carbon dioxide emissions at 1988 levels through to 2005.

Economic instruments were the most effective in achieving a 20 per cent reduction in carbon dioxide emissions by 2005 relative to 1988 scenario objectives (Figure 3 and Figure 4). This result is not surprising since the economic strategies applied utilized instruments designed to achieve the scenario objectives. For example, to achieve a 20 per cent reduction in 1988 carbon dioxide emissions by 2005 a carbon tax resulting in a 38 per cent reduction in the transportation sector's fuel consumption by 2005 is required. At present this appears to be an ambitious target.

Alternatively it is difficult to achieve the twenty per cent reduction of 1988 carbon dioxide emissions by 2005 utilizing only regulatory instruments. In Section 4.4.3, passenger vehicle travel was restricted by 30 per cent to achieve the 20 reduction in carbon dioxide emissions by 2005 relative to 1988 scenario target. Such a restriction on travel demand would result in significant change in lifestyles. The regulatory strategy for achieving the 20 per cent reduction in carbon dioxide emissions, best position for future reductions (Section 4.4.1, 4.4.4) required a 20 per cent restriction of passenger vehicle travel (analysis indicated that travel could be restricted by about 10 per cent by 2005). The large restriction of travel demand was used to achieve the scenario objective. If the more realistic restriction on travel demand originally proposed was used regulatory instruments alone could not achieve the objectives of a 20 per cent reduction in carbon dioxide emissions.

Overall, a combination of both economic and regulatory measures more readily achieve all the scenario objectives. For example, the combined economic and regulatory instruments mix used to analyze actions economically attractive to society (Section 4.4.1, 4.4.4) achieved the 2000 objective of stable 1988 carbon dioxide emissions target.

Table 4-4

Summary results of revised energy use and emissions for the transportation sector of Ontario by scenario and measure(c)

Scenario	Strategy	Measure	Reduction in energy use from base case 1988(a) (PJ/a) 1995	2000	2005	Per cent change from base case 1988 Energy use(b) 1995	2000	2005
Actions Economically Attractive to Society in Their Own Right by 2005	1	Economic Instruments	(75)	(105)	(141)	12%	17%	23%
	2	Regulatory Instruments	(63)	(25)	(34)	10%	4%	5%
	3	Both Instruments	(52)	(5)	(4)	8%	1%	1%
Zero Per Cent Increase in CO2 Emissions by 2000 Relative to 1988	1	Economic Instruments	(30)	6	(32)	5%	-1%	5%
	2	Regulatory Instruments	(55)	4	11	9%	-1%	-2%
	3	Both Instruments	(56)	(2)	3	9%	0%	0%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988 at Least Cost	1	Economic Instruments	(10)	51	145	2%	-8%	-24%
	2	Regulatory Instruments	(51)	32	127	8%	-5%	-21%
	3	Both Instruments	(36)	51	113	6%	-8%	-18%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988, Best Position for Future Reductions	1	Economic Instruments	1	74	171	0%	-12%	-28%
	2	Regulatory Instruments	(39)	51	119	6%	-8%	-19%
	3	Both Instruments	(24)	74	147	4%	-12%	-24%

Note:

(a) ( ) indicates an increase in energy use or emissions from base case 1988.

(b) A negative value indicates a decrease from base case 1988.

(c) Differences in the effectiveness of strategies for each scenario does not suggest that one strategy is superior but that a different mix of measures is used.

Table 4-4

Summary results of revised energy use and emissions for the transportation sector of Ontario by scenario and measure(c)

Scenario	Strategy	Measure	Change in carbon dioxide emissions from base case 1988(a) (000's tonnes/a)			Per cent change from base case 1988 carbon dioxide emissions(b)		
			1995	2000	2005	1995	2000	2005
Actions Economically Attractive to Society in Their Own Right by 2005	1	Economic Instruments	(5 191)	(7 262)	(9 783)	12%	17%	23%
	2	Regulatory Instruments	(4 361)	(1 822)	(2 479)	10%	4%	6%
	3	Both Instruments	(3 584)	(451)	(461)	8%	1%	1%
Zero Per Cent Increase in CO2 Emissions by 2000 Relative to 1988	1	Economic Instruments	(2 092)	343	(2 306)	5%	-1%	5%
	2	Regulatory Instruments	(3 819)	170	597	9%	0%	-1%
	3	Both Instruments	(3 861)	(273)	15	9%	1%	0%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988 at Least Cost	1	Economic Instruments	(719)	3 442	9 891	2%	-8%	-23%
	2	Regulatory Instruments	(3 558)	2 033	8 503	8%	-5%	-20%
	3	Both Instruments	(2 488)	3 371	7 513	6%	-8%	-18%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988, Best Position for Future Reductions	1	Economic Instruments	77	5 009	11 650	0%	-12%	-28%
	2	Regulatory Instruments	(2 697)	3 394	7 918	6%	-8%	-19%
	3	Both Instruments	(1 659)	4 957	9 839	4%	-12%	-23%

Note:

(a) ( ) indicates an increase in energy use or emissions from base case 1988.

(b) A negative value indicates a decrease from base case 1988.

(c) Differences in the effectiveness of strategies for each scenario does not suggest that one strategy is superior but that a different mix of measures is used.

Table 4-4
Summary results of revised energy use and emissions for the transportation sector of Ontario by scenario and measure(c)

Scenario	Strategy	Measure	Reduction in sulphur dioxide emissions from base case 1988(a) (000's tonnes/a) 1995	2000	2005	Per cent change from base case 1988 SO2 emissions(b) 1995	2000	2005
Actions Economically Attractive to Society in Their Own Right by 2005	1	Economic Instruments	(4)	(9)	(13)	13%	27%	38%
	2	Regulatory Instruments	(4)	(5)	(8)	12%	17%	24%
	3	Both Instruments	(3)	(5)	(7)	11%	15%	21%
Zero Per Cent Increase in CO2 Emissions by 2000 Relative to 1988	1	Economic Instruments	(2)	(3)	(7)	7%	9%	20%
	2	Regulatory Instruments	(4)	(4)	(6)	11%	14%	19%
	3	Both Instruments	(4)	(5)	(7)	11%	15%	21%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988 at Least Cost	1	Economic Instruments	(1)	(1)	2	4%	3%	-6%
	2	Regulatory Instruments	(3)	(3)	(2)	11%	10%	7%
	3	Both Instruments	(3)	(3)	(3)	9%	9%	10%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988, Best Position for Future Reductions	1	Economic Instruments	(1)	(0)	3	3%	1%	-8%
	2	Regulatory Instruments	(3)	(2)	(2)	9%	7%	6%
	3	Both Instruments	(3)	(2)	(1)	8%	5%	3%

Note:
(a) ( ) indicates an increase in energy use or emissions from base case 1988.
(b) A negative value indicates a decrease from base case 1988.
(c) Differences in the effectiveness of strategies for each scenario does not suggest that one strategy is superior but that a different mix of measures is used.

Table 4-4

Summary results of revised energy use and emissions for the transportation sector of Ontario by scenario and measure(c)

Scenario	Strategy	Measure	Reduction in nitrogen oxide emissions from base case 1988(a) (000's tonnes/a) 1995	2000	2005	Per cent change from base case 1988 NOx emissions(b) 1995	2000	2005
Actions Economically Attractive to Society in Their Own Right by 2005	1	Economic Instruments	84	117	107	-27%	-38%	-35%
	2	Regulatory Instruments	81	113	100	-26%	-37%	-32%
	3	Both Instruments	84	117	107	-27%	-38%	-35%
Zero Per Cent Increase in CO2 Emissions by 2000 Relative to 1988	1	Economic Instruments	84	118	106	-27%	-38%	-35%
	2	Regulatory Instruments	82	115	104	-27%	-38%	-34%
	3	Both Instruments	83	117	107	-27%	-38%	-35%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988 at Least Cost	1	Economic Instruments	86	121	117	-28%	-40%	-38%
	2	Regulatory Instruments	82	117	131	-27%	-38%	-43%
	3	Both Instruments	86	121	126	-28%	-40%	-41%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988, Best Position for Future Reductions	1	Economic Instruments	89	127	125	-29%	-41%	-41%
	2	Regulatory Instruments	84	120	125	-27%	-39%	-41%
	3	Both Instruments	88	126	132	-29%	-41%	-43%

Note:

(a) ( ) indicates an increase in energy use or emissions from base case 1988.

(b) A negative value indicates a decrease from base case 1988.

(c) Differences in the effectiveness of strategies for each scenario does not suggest that one strategy is superior but that a different mix of measures is used.

Table 4-4

Summary results of revised energy use and emissions for the transportation sector of Ontario by scenario and measure(c)

Scenario	Strategy	Measure	Reduction in VOCs emissions from base case 1988(a) (000's tonnes/a) 1995	2000	2005	Per cent change from base case 1988 VOCs emissions(b) 1995	2000	2005
Actions Economically Attractive to Society in Their Own Right by 2005	1	Economic Instruments	73	109	105	-30%	-45%	-44%
	2	Regulatory Instruments	69	103	96	-29%	-43%	-40%
	3	Both Instruments	73	109	105	-30%	-45%	-44%
Zero Per Cent Increase in CO2 Emissions by 2000 Relative to 1988	1	Economic Instruments	71	107	101	-29%	-44%	-42%
	2	Regulatory Instruments	70	107	102	-29%	-44%	-42%
	3	Both Instruments	72	109	107	-30%	-45%	-44%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988 at Least Cost	1	Economic Instruments	74	111	114	-31%	-46%	-47%
	2	Regulatory Instruments	70	108	139	-29%	-45%	-57%
	3	Both Instruments	76	115	133	-31%	-48%	-55%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988, Best Position for Future Reductions	1	Economic Instruments	78	118	124	-32%	-49%	-51%
	2	Regulatory Instruments	72	112	130	-30%	-47%	-54%
	3	Both Instruments	77	120	140	-32%	-50%	-58%

Note:

(a) ( ) indicates an increase in energy use or emissions from base case 1988.

(b) A negative value indicates a decrease from base case 1988.

(c) Differences in the effectiveness of strategies for each scenario does not suggest that one strategy is superior but that a different mix of measures is used.

Table 4-4

Summary results of revised energy use and emissions for the transportation sector of Ontario by scenario and measure(c)

Scenario	Strategy	Measure	Reduction in particulate emissions from base case 1988(a) (000's tonnes/a)			Per cent change from base case 1988 particulate emissions(b)		
			1995	2000	2005	1995	2000	2005
Actions Economically Attractive to Society in Their Own Right by 2005	1	Economic Instruments	(8)	(12)	(16)	20%	31%	43%
	2	Regulatory Instruments	(8)	(14)	(20)	22%	37%	52%
	3	Both Instruments	(8)	(12)	(16)	20%	31%	43%
Zero Per Cent Increase in CO2 Emissions by 2000 Relative to 1988	1	Economic Instruments	(8)	(13)	(18)	21%	34%	47%
	2	Regulatory Instruments	(8)	(13)	(17)	21%	33%	46%
	3	Both Instruments	(8)	(12)	(16)	20%	31%	41%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988 at Least Cost	1	Economic Instruments	(7)	(11)	(13)	19%	30%	36%
	2	Regulatory Instruments	(8)	(12)	(4)	21%	32%	11%
	3	Both Instruments	(7)	(10)	(6)	18%	26%	17%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988, Best Position for Future Reductions	1	Economic Instruments	(6)	(9)	(10)	17%	23%	25%
	2	Regulatory Instruments	(8)	(11)	(7)	20%	28%	19%
	3	Both Instruments	(6)	(8)	(4)	17%	22%	9%

Note:

(a) ( ) indicates an increase in energy use or emissions from base case 1988.

(b) A negative value indicates a decrease from base case 1988.

(c) Differences in the effectiveness of strategies for each scenario does not suggest that one strategy is superior but that a different mix of measures is used.

Table 4-4

Summary results of revised energy use and emissions for the transportation sector of Ontario by scenario and measure(c)

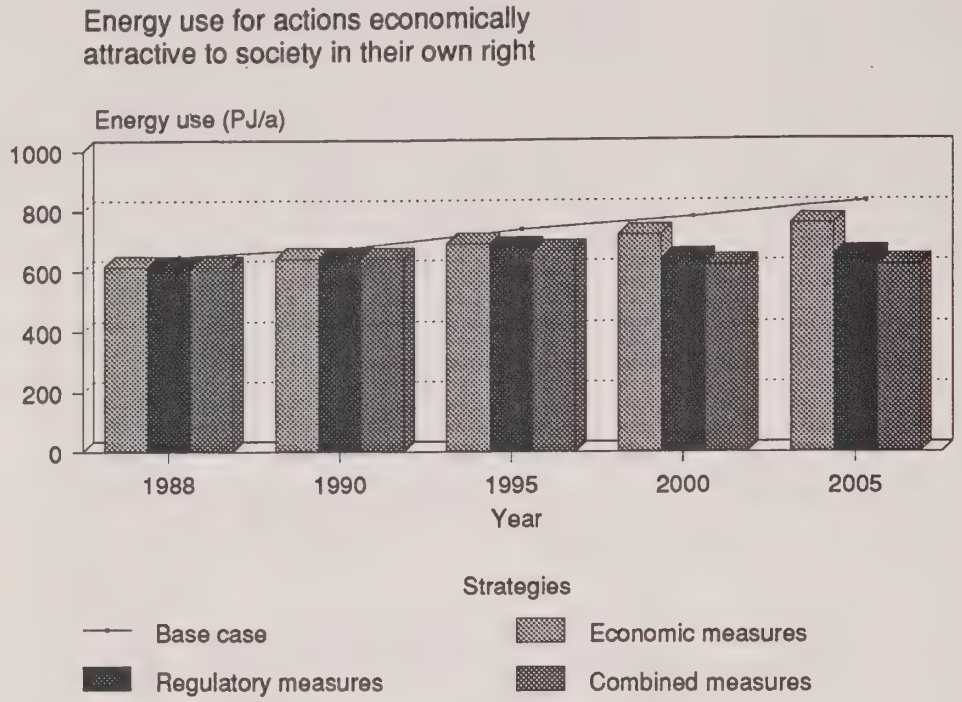
Scenario	Strategy	Measure	Reduction in carbon monoxide emissions from base case 1988(a) (000's tonnes/a) 1995	2000	2005	Per cent change from base case 1988 CO emissions(b) 1995	2000	2005
Actions Economically Attractive to Society in Their Own Right by 2005	1	Economic Instruments	704	921	887	-37%	-49%	-47%
	2	Regulatory Instruments	678	877	817	-36%	-46%	-43%
	3	Both Instruments	704	921	887	-37%	-49%	-47%
Zero Per Cent Increase in CO2 Emissions by 2000 Relative to 1988	1	Economic Instruments	691	901	852	-36%	-48%	-45%
	2	Regulatory Instruments	689	904	865	-36%	-48%	-46%
	3	Both Instruments	700	922	903	-37%	-49%	-48%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988 at Least Cost	1	Economic Instruments	709	931	945	-37%	-49%	-50%
	2	Regulatory Instruments	689	915	1 145	-36%	-48%	-60%
	3	Both Instruments	726	964	1 099	-38%	-51%	-58%
Twenty Per Cent Reduction in CO2 Emissions by 2005 Relative to 1988, Best Position for Future Reductions	1	Economic Instruments	740	987	1 025	-39%	-52%	-54%
	2	Regulatory Instruments	702	947	1 077	-37%	-50%	-57%
	3	Both Instruments	739	1 003	1 157	-39%	-53%	-61%

Note:

(a) ( ) indicates an increase in energy use or emissions from base case 1988.

(b) A negative value indicates a decrease from base case 1988.

(c) Differences in the effectiveness of strategies for each scenario does not suggest that one strategy is superior but that a different mix of measures is used.



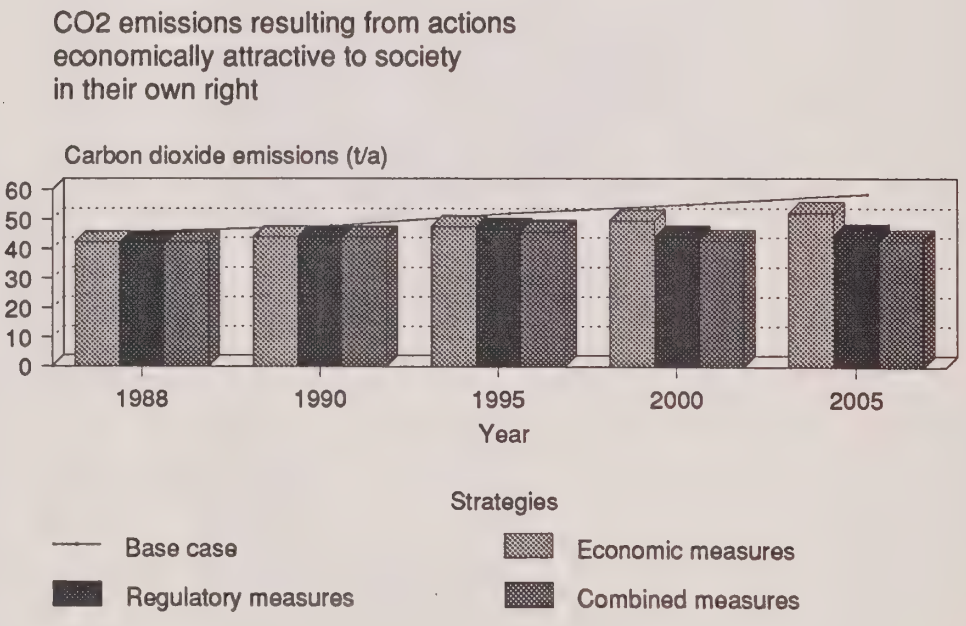
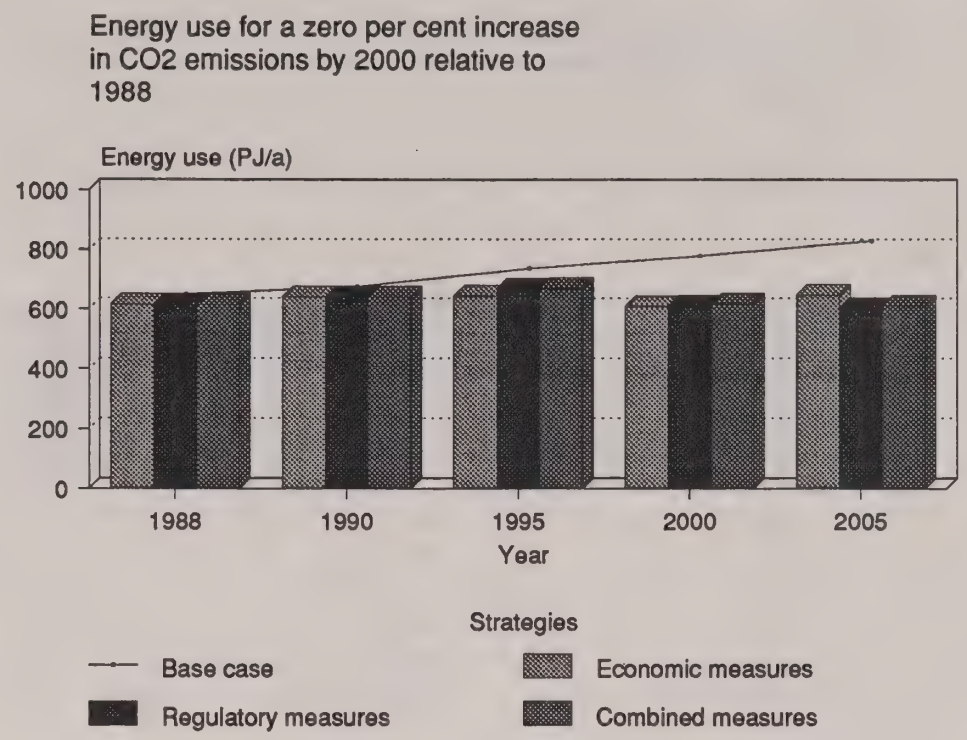


Figure 1
Actions economically attractive to society, energy use and emissions



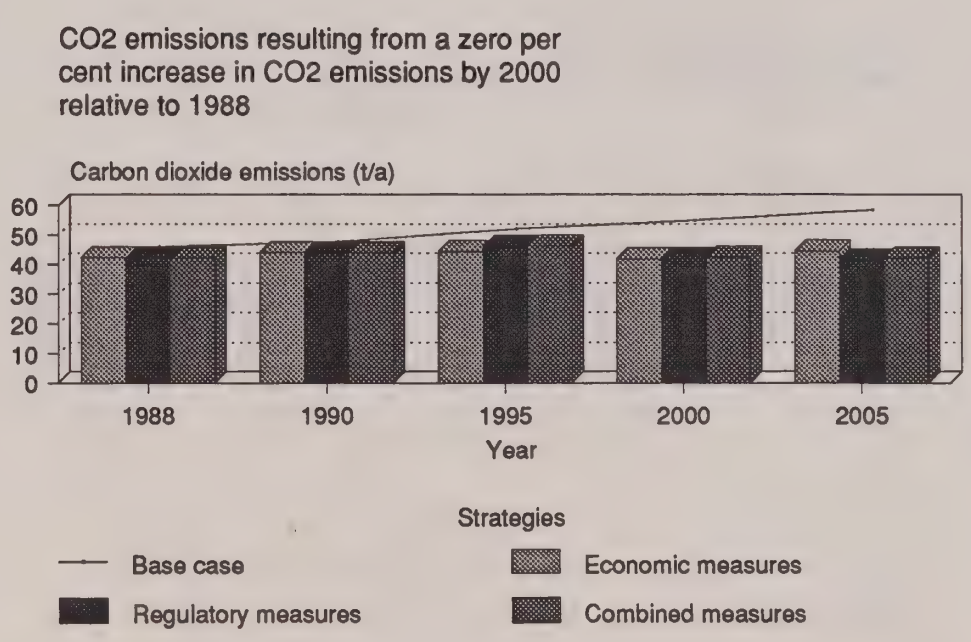
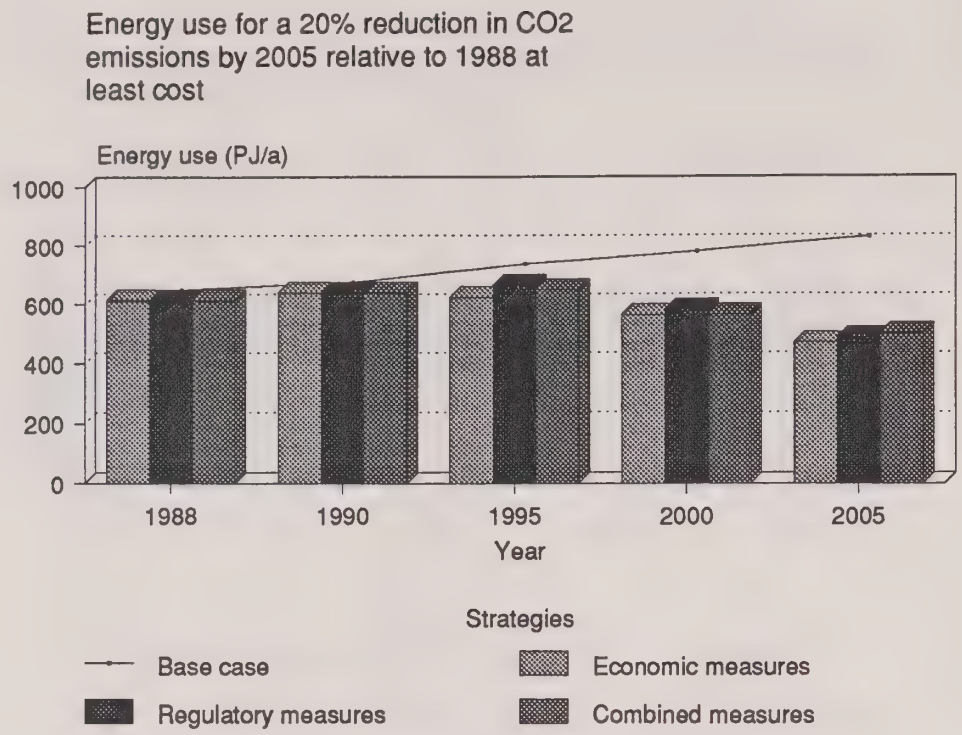


Figure 2
Zero per cent increase in CO2 emissions by 2000, energy use and emissions



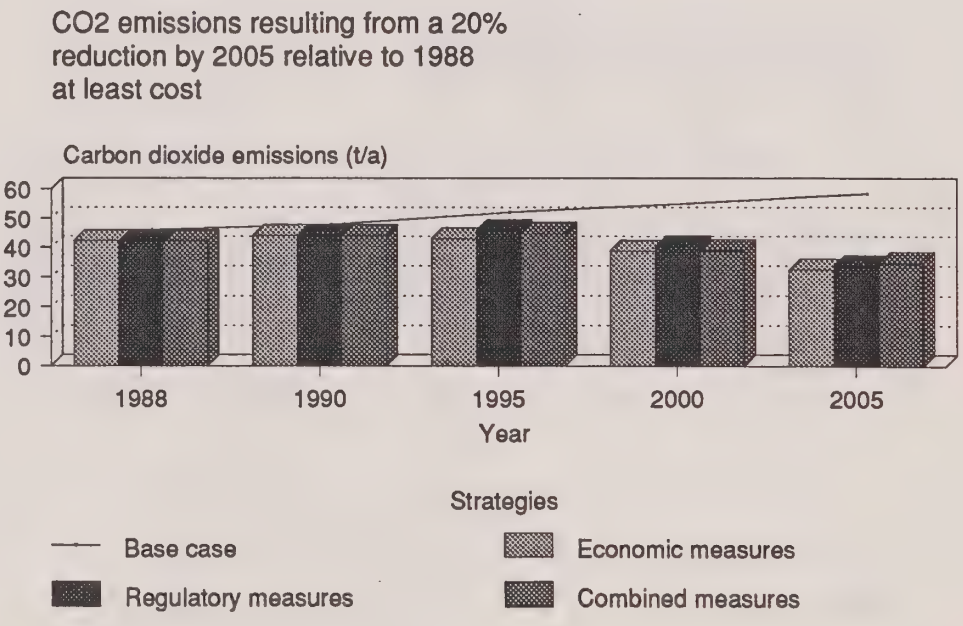
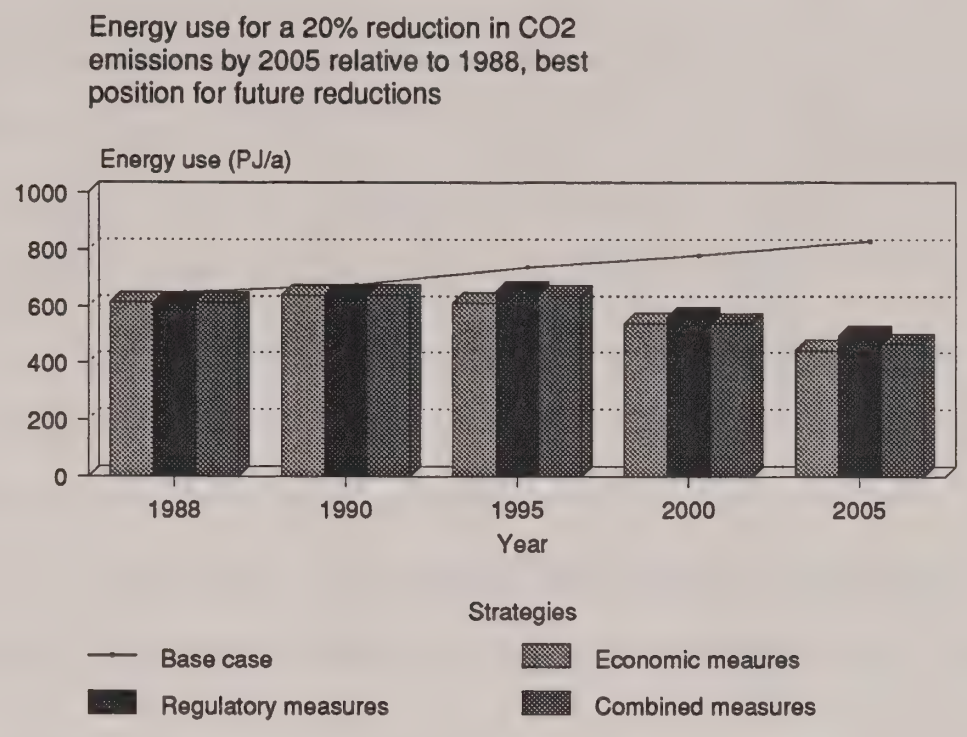


Figure 3
20 per cent reduction in CO2 emissions by 2005 at least cost



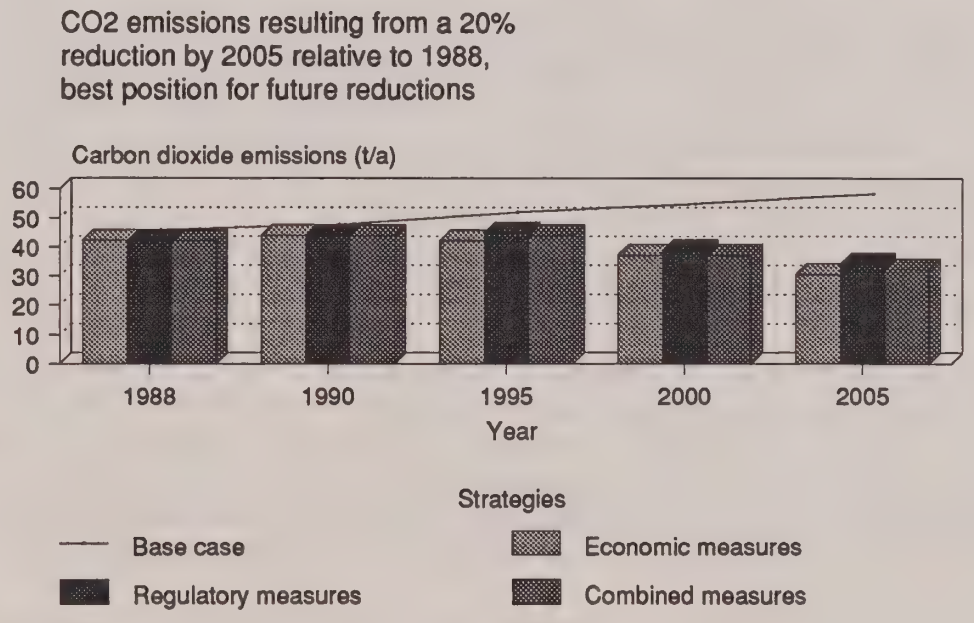


Figure 4.4
20 per cent reduction in CO2 emissions by 2005, best position for the future

5 Conclusions

This study provides the following information:

- estimates of current and projected levels of energy use and emissions, assuming no new policy initiatives
- a review of the major actions and measures that can be taken to reduce energy in the transportation sector, their cost and effectiveness, when taken alone
- a methodology for assessing the interaction of policy or program measures, and the effect of groups of measures (i.e. scenarios) on total energy use and emissions
- an assessment of twelve scenarios—a regulatory, fiscal and mixed scenario for each of four CO_2 reduction targets.

Current and projected levels of energy use and emissions

Ontario used about 615 PJ of energy for transportation in 1988. In the absence of any new policy or program initiatives, this can be expected to rise to 794 PJ/a in 2005—almost a 30 percent increase. Carbon dioxide emissions are expected to increase by the same percentage, from 42 million tonnes per annum to 51 million tonnes per annum in 2005. As a result of initiatives already taken, emissions of NO_x, CO and VOCs are expected to fall to 2000 as a result of new regulatory requirements, but after 2000 these will begin to increase again due to population growth.

Major actions and measures

Eight major measures or groups of measures were considered:

- standards for new vehicles
- measures to induce shifts from automobiles to public transit
- economic instruments to stimulate the use of efficient vehicles
- land-use measures to reduce the need for travel, particularly automobile travel
- traffic management measures
- inspection and maintenance programs for vehicles
- measures to encourage the use of communications instead of transportation
- regulatory measures to restrict the demand for transportation services or fuel for use in transportation.

Estimates of the effect of each of these are provided, and in some cases it is possible to provide information on the costs and fuel saving benefits of measures, at least relative to the base case.

Methodology for combining measures

A methodology is presented for combining the effects of various measures making up a strategy. The method is based on a very disaggregated analysis, and avoids some of the problems posed by the MENY model, in which it is virtually impossible to increase transit modal share, or to reduce the demand for travel in the absence of a real decline in the standard of living of Ontario residents.

Assessment of strategies

Twelve strategies are assessed, representing regulatory, fiscal and mixed approaches to achieving four different emissions reductions objectives:

- targeting CO_2 emission reductions that can be achieved with no net economic cost
- stabilizing emissions of CO_2 by 2000 at 1988 emission levels

- reducing emissions of CO_2 by 2005 to 80 per cent of 1988 emission levels at the least cost

- reducing emissions of CO_2 by 2005 to 80 per cent of 1988 emission levels with the potential to further reduce CO_2 emissions after that.

The analysis suggests that emissions can be stabilized by 2000 to 1988 levels at no or minimal cost to society, and without significant lifestyle changes. However, achieving more dramatic reductions in emissions will not be easy — there may well be economic costs and lifestyle changes required. The distribution of these economic costs will result in economic benefits to some firms and individuals and economic costs to others.

The analysis presented here should be seen as a general overview. Considerable additional work is required before implementing the measures reviewed including:

- giving consideration to the distribution of costs and benefits

- providing better geographic resolution of likely effects for measures that are sensitive to the geographic setting

- equity and effectiveness issues related to the choice of regulatory or fiscal mechanisms

- the extent and acceptability of any required lifestyle changes

- implementation issues including timing, and coordination with other governments.

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Appendix A Detailed information on actions and measures

Appendix A Detailed information on actions and measures

The following table presents detailed information about the types of measures and actions that can be taken to reduce energy use and emissions from transportation. The information was gathered through a review of literature which examined technical measures and policy actions which would either reduce the demand for energy or emissions. Where possible the following information was collected:

- type of measure;
- measures energy conserving potential;
- emissions reduction potential; and
- related costs;

Table A-1 lists these measures and actions by the transportation sector targeted. Where possible the Table provides the following information:

- transportation target group;
- type of measure or action taken;
- an example of that measure;
- technical sector energy savings in 2005 (%);
- market sector energy savings in 2005 (%);
- total transportation sector energy savings in 2005 (%);
- estimated economic benefits in $1988;
- capital costs of the measure in $1988;
- annual operation and maintenance costs in $1988;
- total annualized costs in $1988;
- annual net costs in $1988;
- estimated possible emissions reduction;
- additional comments; and
- a reference number indicating from which document the information was obtained.

Table A-1
Measures and energy effects

Target	Type of measure	Example measures, actions	Technical Sector Energy Savings in 2005 (%)	Market Sector Energy Savings in 2005 (%)	Total Energy Savings in 2005 (%)	Annual benefits (M1988$)	Capital costs (M1988$)	Annual costs (M1988$)	Annual net costs (M1988$)	Comments	Reference
Automobile	Energy Demand	Fuel-Efficient Driving Habits									A9
Automobile - Urban	Energy Demand	Modal Shift	40.0	20.0	11.7	$1,311		$0	($23,336)		A8
Automobile - Urban	Energy Demand	Demand Management	0.1		0.0	$3					A9
Automobile - Urban	Energy Demand	Modal Shifts (5%)									A9
Automobile - Urban	Energy Demand	Demand Reduction	1.1		0.3	$36					A9
Automobile - Urban	Energy Demand	Reversible Lanes	9.0		2.6	$295					A11
Urban	Energy Demand	Area-Wide Ridesharing	4.0		1.3	$141					A5
Urban	Energy Demand	Land Zoning	12.5		3.9	$441					A5
Urban	Energy Demand	Density Management	23.5		7.4	$830					A5
Urban	Energy Demand	Ridesharing	3.0		0.9	$106					A5
Urban	Energy Demand	Modal Shifts (10% car to carpool)	3.1		1.0	$109					A5
Urban	Energy Demand	Modal Shifts (10% carpool to bus)	1.1		0.3	$39					A5
Urban	Energy Demand	Parking Management	4.5		1.4	$159					A5
Urban	Energy Demand	Modal Shifts (10% car to bus)	5.5		1.7	$194					A5
Urban	Energy Demand	Off-peak Fare Incentives	0.8		0.2	$26					A5
Automobile - Urban	Fiscal	Double Gas Price	5.0		1.5	$164					A3
Air Travel	Fuel Efficiency	Airplane Technology	50.0		1.7	$176					A1

Table A-1
Measures and energy effects

Target	Type of measure	Example measures, actions	Technical Sector Energy Savings in 2005 (%)	Market Sector Energy Savings in 2005 (%)	Total Energy Savings in 2005 (%)	Annual benefits (M1988$)	Capital costs (M1988$)	Annual costs (M1988$)	Annual net costs (M1988$)	Comments	Reference
Air Travel	Fuel Efficiency	Airplane Technology	29.8	10.0	1.0	$105			($2,523)		A8
Air Travel	Fuel Efficiency	Airplane Technology				$0					A9
Automobile	Fuel Efficiency	Auto Technology	30.0		13.1	$1,477					A14
Automobile	Fuel Efficiency	Auto Technology	66.0	22.5	28.9	$3,250					
Automobile	Fuel Efficiency	Auto Technology	66.0	22.5	28.9	$3,250					A1
Automobile	Fuel Efficiency	Constant Tuning	2.5		1.1	$123					A12
Automobile	Fuel Efficiency	Use Low-friction Lubricants	3.0		1.3	$148					A12
Automobile	Fuel Efficiency	Inspection and Maintenance Programs									A9
Automobile	Fuel Efficiency	Auto Technology	77.0		33.7						A4
Automobile	Fuel Efficiency	Auto Technology	47.6		20.8	$2,344					A9
Automobile	Fuel Efficiency	Improved Vehicle Maintenance	15.0	0.0	6.6	$739			$168		A8
Automobile	Fuel Efficiency	Auto Technology	52.4	40.0	22.9	$2,578					A2
Automobile	Fuel Efficiency	No Air Conditioning	2.0		0.9	$98					A12
Automobile	Fuel Efficiency	Auto Technology	86.0	50.0	37.7	$4,235		$2,066	($2,169)		A10
Automobile	Fuel Efficiency	Auto Technology	30.0		13.1	$1,477	$1,970	$141	($1,337)		A6
Automobile	Fuel Efficiency	Raise Tire Pressures	5.6		2.5	$276					A12
Automobile	Fuel Efficiency	Speed Limit Enforcement	1.1		0.5	$54					A9
Automobile - Urban	Fuel Efficiency	Staggered Work Hours	5.0	0.3	1.5	$164			($340)		A8
Automobile - Urban	Fuel Efficiency	Compressed Work Week (10% of Force)	0.7		0.2	$23		1980 US$0.043 per USgal	($39)		A3

Table A-1
Measures and energy effects

Target	Type of measure	Example measures, actions	Technical Sector Energy Savings in 2005 (%)	Market Sector Energy Savings in 2005 (%)	Total Energy Savings in 2005 (%)	Annual benefits (M1988$)	Capital costs (M1988$)	Annual costs (M1988$)	Annual net costs (M1988$)	Comments	Reference
Automobile - Urban	Fuel Efficiency	Freeway Controls	9.0		2.6	$295					A11
Automobile - Urban	Fuel Efficiency	Traffic Signal Coordination	12.5		3.6	$410					A11
Automobile - Urban	Fuel Efficiency	Traffic Management	0.2		0.1	$7					A9
Automobile - Urban	Fuel Efficiency	Traffic Operations & Geometrics	4.0		1.2	$131					A5
Automobile - Urban	Fuel Efficiency	Ridesharing	1.0		0.3	$33		1980 US$0.06 - 0.26 per USgal	($52)		A3
Automobile - Urban	Fuel Efficiency	Traffic Signal Improvements	3.5		1.0	$115		1980 US$0.08 - 0.13 per USgal	($188)		A3
Automobile - Urban	Fuel Efficiency	Right-turn-on-red-after-stop	0.5		0.1					Costs are mostly for surveys	A3
Automobile - Urban	Fuel Efficiency	Public Transit Expansion	1.0		0.3	$33		1980 US$5.00 per USgal	$97	Needs justification on more than just fuel savings	A3
Automobile - Urban	Fuel Efficiency	HOV Programs	0.7		0.2	$23					A9
Automobile - Urban	Fuel Efficiency	Signal Removal & Flashing	0.6		0.2	$20				Needs care to avoid adverse safety affects	A3
Automobile - Urban	Fuel Efficiency	HOV Lanes	0.5		0.1	$16		1980 US$1.20 - 5.40 per USgal	($6)		A3
Automobile - Urban	Fuel Efficiency	Turning Movement Restrictions	4.0		1.2	$131					A11
Automobile - Urban	Fuel Efficiency	Bus Bays	4.0		1.2	$131					A11
Automobile - Urban	Fuel Efficiency	Intersection Widening	20.0		5.8	$656					A11

Table A-1
Measures and energy effects

Target	Type of measure	Example measures, actions	Technical Sector Energy Savings in 2005 (%)	Market Sector Energy Savings in 2005 (%)	Total Energy Savings in 2005 (%)	Annual benefits (M1988$)	Capital costs (M1988$)	Annual costs (M1988$)	Annual net costs (M1988$)	Comments	Reference
Automobile - Urban	Fuel Efficiency	Prohibited Turning	0.1		0.0	$3					A7
Automobile - Urban	Fuel Efficiency	Alternative Work Schedules (50% of Force)	0.1		0.0	$4		1980 US$0.28 per USgal	($5)		A3
Automobile - Urban	Fuel Efficiency	Parking Management	0.5		0.1	$16					A5
Automobile - Urban	Fuel Efficiency	HOV Programs									A11
Automobile - Urban	Fuel Efficiency	Lower Freeway Speeds	1.0		0.3	$31					A7
Automobile - Urban	Fuel Efficiency	Improved Signal Timing	6.0		1.7	$197					A11
Automobile - Urban	Fuel Efficiency	Freeway Traffic Management	0.4	0.2	0.1	$12		1980 US$1.39 - 1.58 per USgal	($4)		A3
Automobile - Urban	Fuel Efficiency	Traffic Control	15.0		4.4	$492					A5
Automobile - Urban	Fuel Efficiency	Parking/Stopping	0.2		0.1	$7					A7
Automobile - Urban	Fuel Efficiency	Urban Traffic Management	25.0	29.8	7.3	$820		$0	($13,233)		A8
Automobile - Urban	Fuel Efficiency	Optimizing Lights	3.0		0.9	$98					A7
Automobile - Urban	Fuel Efficiency	One-Way Streets	15.0		4.4	$492					A11
Light Trucks	Fuel Efficiency	Truck Technology	45.0	13.5					($5,093)		A8
Marine	Fuel Efficiency	General Speed Reduction	15.5		0.3	$8					A13
Marine	Fuel Efficiency	Regular Propeller Maintenance	0.4		0.0	$0					A13
Marine	Fuel Efficiency	Use of Anti-fouling Coatings	4.5		0.1	$2					A13

Table A-1
Measures and energy effects

Target	Type of measure	Example measures, actions	Technical Sector Energy Savings in 2005 (%)	Market Sector Energy Savings in 2005 (%)	Total Energy Savings in 2005 (%)	Annual benefits (M1988$)	Capital costs (M1988$)	Annual costs (M1988$)	Annual net costs (M1988$)	Comments	Reference
Marine	Fuel Efficiency	Large, Slow Turning Propellers	5.0		0.1	$3					A13
Marine	Fuel Efficiency	Use of Anti-fouling Coatings on First 1/4	1.8		0.0	$1					A13
Marine	Fuel Efficiency	Satellite Navigation	0.5		0.0	$0					A13
Marine	Fuel Efficiency	Retrofit Propeller	5.0		0.1	$3					A13
Marine	Fuel Efficiency	Ship Engine Technology	25.0		0.5	$13					A13
Marine - Containerships	Fuel Efficiency	Ship Trim Optimization	10.3								A13
Marine - Diesel	Fuel Efficiency	Waste Heat Recovery	7.0								A13
Marine - Liners	Fuel Efficiency	Contra-rotating Propellers	6.5								A13
Marine - Low Speed Ships	Fuel Efficiency	Ducted or Nozzle Propellers	4.0								A13
Marine - New Ships	Fuel Efficiency	Controllable-pitch Propellers	3.5								A13
Marine - Steam	Fuel Efficiency	Use of Electric Pumps	15.0								A13
Marine - Tanker	Fuel Efficiency	Use of Medium-speed Diesel Ships	25.0								A13
Marine - Tanker/Liner	Fuel Efficiency	Use of Low-speed Diesel Ships	25.0								A13
Truck Transport Diesel	Fuel Efficiency	Driving Reductions	4.0		0.8	$86					A15
Truck Transport Diesel	Fuel Efficiency	Truck Technology	12.0	3.6	2.6	$260			($2,503)		A8
Truck Transport Diesel	Fuel Efficiency	Truck Technology	44.0		9.4	$953		$92	($860)		A10

Table A-1
Measures and energy effects

Target	Type of measure	Example measures, actions	Technical Sector Energy Savings in 2005 (%)	Market Sector Energy Savings in 2005 (%)	Total Energy Savings in 2005 (%)	Annual benefits (M1988$)	Capital costs (M1988$)	Annual costs (M1988$)	Annual net costs (M1988$)	Comments	Reference
Truck Transport Diesel	Fuel Efficiency	Truck Capacity	25.0	7.4	5.3	$541			($1,592)		A8
Truck Transport Diesel	Fuel Efficiency	Truck Technology	60.0	17.8	12.8	$1,299					A1
Urban	Fuel Efficiency	Park and Ride/HOV	0.8		0.2	$26					A5
Urban	Fuel Efficiency	Urban Municipal Fleet Management	27.5		8.6	$971					A5
Urban	Fuel Efficiency	Express Service	0.6		0.2	$21					A5
Urban	Fuel Efficiency	Traffic Engineering	2.0		0.6	$71					A5
Urban	Fuel Efficiency	Service Expansion	1.8		0.5	$62					A7
Urban Trucking	Fuel Efficiency	Staggered Work Hours	4.0		0.5	$55					A15
Urban Trucking	Fuel Efficiency	Improved Vehicle Maintenance	15.0	3.0	2.0	$205			($696)		A8
Urban - Bus	Fuel Efficiency	Diesel/Flywheel Hybrid	25.0		0.2	$23					A15
Urban - Bus	Fuel Efficiency	Diesel/Hydraulic Accumulator	22.5		0.2	$21			zero		A15
Urban - Bus	Fuel Efficiency	K-Cycle Engine	30.0		0.3	$28					A15
Automobile	Fuel Switching	Oxygenated Fuels									A9
Automobile	Fuel Switching	Propane Fuel	0.6	0.0	0.3	$30			$2,659		A8
General Freight - Rail	Fuel Switching	Rail Electrification	68.4	0.0	1.7	$173			($736)		A8
Marine	Fuel Switching	Use of Coal-fired Boilers	95.0		2.0	$49					A13
Marine	Fuel Switching	Use of Fuel-oil Modifications	2.5		0.1	$1					A13
Marine	Fuel Switching	Use of Coal-oil for Boilers	27.5		0.6	$14					A13

Table A-1
Measures and energy effects

Target	Type of measure	Example measures, actions	Technical Sector Energy Savings in 2005 (%)	Market Sector Energy Savings in 2005 (%)	Total Energy Savings in 2005 (%)	Annual benefits (M1988$)	Capital costs (M1988$)	Annual costs (M1988$)	Annual net costs (M1988$)	Comments	Reference
Marine - Small Ships	Fuel Switching	Wind Assistance	20.0								A13
Specific Freight - Rail	Fuel Switching	Rail Electrification	68.4	0.0	0.6	$62			($946)		A8
Urban Trucking	Fuel Switching	Propane Fuel	0.6	0.0	0.1	$8			$467		A8
Urban - Bus	Fuel Switching	Alchohol							-ve		A15
Urban - Bus	Fuel Switching	Electric Trolley Coach							-ve		A15
Urban - Bus	Fuel Switching	Propane							-ve		A15
Urban - Bus	Fuel Switching	Electric Trolley/Diesel							+ve		A15
Urban - Bus	Fuel Switching	Electric Trolley/Flywheel							+ve		A15

Notes to Table A-1

1) *Technical Sector Energy Savings in 2005* refers to the maximum possible savings (in per cent) for the target sector. Blank cells indicate no information available.
2) *Market Sector Energy Savings in 2005* refers to the likely savings (in per cent) for the target sector. Under normal, market conditions (ie. absence of regulation), these savings might be expected. Blank cells indicate no information available.
3) *Total Energy Savings in 2005* refers to the savings (in per cent) of the target sector relative to total transportation energy use in Ontario. Blank cells indicate no information available.
4) *Annual Benefits* are calculated as millions of 1988 dollars saved. The calculation is made by multiplying the Technical Energy Savings by the energy use of the sector in 2005. The benefit is the value of the fuel saved in 1988 dollars. Fuel values are based on MENY Energy Prices Model.
5) *Annual Net Costs* are the difference between *Annual Costs* and *Annual Benefits*.

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A14 Streb, A.J. 1989.
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Appendix B Calculation framework

Appendix B Calculation framework

B.1 Baseline scenario

Estimates of energy savings and emissions reductions associated with the measures considered in this report were assessed using a simple calculation framework consisting of a set of 15 tables for each strategy considered. The general structure of each table is the same, with 43 transportation modes shown in rows, and the year affected for each of five years shown in columns. Table B-1 presents a simplified example of the table structure.

The fifteen tables making up a scenario are listed in Table B-2. Table B-2 also indicates how these individual tables are used in estimating total energy demand or total emissions.

Except for passenger automobiles, a full data set is not available, and some of the values are shown as dimensionless variables, relative to the 1988 base year. For example, from the Ministry of Energy Energy Demand Model, energy use for general freight is presented in megajoules per tonne kilometre, and thus vehicle demand is presented in tonne-kilometres, the same units as transportation demand—loading is set to 1.0. Similarly, demand for general and government aviation, motorcycles, school buses and leisure vehicles is presented in megajoules per annum. Consequently, the vehicle efficiency is presented as a dimensionless number relative to 1988.

Table B-4 the base case transportation and energy forecast. The unit emission factors by pollutant and transport mode used to calculate baseline emissions are presented in Table B-5. Baseline emissions projects are presented in Table B-6.

Table B-1
Example table, showing transportation modes and years considered

Transport mode	Year				
	1988	1990	1995	2000	2005
Urban automobiles					
Urban light trucks					
Streetcars and subways					
Bus					

B.2 Effects of strategies

The effects of various strategies are estimated by modifying the tables in the baseline to reflect the effectiveness and penetration of specific energy saving or demand reducing measures. For each strategy, a revised table showing by mode and year the changes in energy use or transportation demand associated with the strategy is prepared. An example of such a table is presented in Table B-3, which indicates that for that strategy there is a 25 percent reduction in the demand for transportation by personal automobiles in 2005, relative to what it would otherwise have been in 2005, and that the demand for public transit is 5 times what it would otherwise have been in 2005[1]. The demand for other modes is not affected by the strategy.

This table is then multiplied by Table A in the base case to get a revised estimate of transportation demand, as a result of the strategy's implementation (Table A′).

Similarly, revised energy efficiencies are calculated by multiplying a table similar in structure to that in Table B-3 for the effect of the strategy on energy efficiency by Table D in the base scenario (Table D′).

[1] Note that this does not imply a reduction in demand of 25 percent relative to 1988, since the 2005 base scenario may incorporate growth or contraction in demand relative to 1988.

Table B-2
Tables required for each strategy.

Identifier code	Description	Sample units	Source of data
A	Demand for transportation	pass.km/a t.km/a	Input
B	Vehicle loading	pass/vehicle t/vehicle	Input
C	Vehicle demand	vehicle.km/a	=A/B
D	Vehicle energy efficiency	MJ/vehicle/km	Input
E	Energy use	MJ/a	=C*D
F.1	Emission rate (NO_x)	g/km	Input
F.2	Emission rate (HC)	g/km	Input
F.3	Emission rate (CO)	g/km	Input
F.4	Emission rate (CO_2)	g/MJ	Input
F.5	Emission rate (SO_2)	g/MJ	Input
G.1	Emissions (NO_x)	kg/a	=C*F.1
G.2	Emissions (HC)	kg/a	=C*F.2
G.3	Emissions (CO)	kg/a	=C*F.3
G.4	Emissions (CO_2)	kg/a	=E*F.4
G.5	Emissions (SO_2)	kg/a	=E*F.5

The effect of the strategy on total energy use and emissions is then calculated by substituting the new tables A′ and D′ for A and D in the base scenario.

B.3 Estimating effects of strategies

The effects of strategies are determined by considering the effects of the individual measures that make up the strategy. A table similar in form to that in Table B-3 is prepared for each measure for transportation demand or energy efficiency. Where measures in a strategy do not lead to the same effects, the effect of the strategy is the product of the effect of each of the measures. For example, if a strategy consists of two measures, one that reduces the fuel economy of the automobile fleet by 25 percent, say through a regulatory standard, and

Table B-3
Example of the effects on demand of a strategy.

Transport mode	Year				
	1988	1990	1995	2000	2005
Urban automobiles	1.0	1.0	0.95	0.85	0.75
Urban light trucks	1.0	1.0	0.95	0.85	0.75
Streetcars and subways	1.0	1.0	1.80	3.40	5.00
Bus	1.0	1.0	1.80	3.40	5.00
Other modes	1.0	1.0	1.0	1.0	1.0

another measure that requires annual inspection and maintenance of automobiles, and leading to a reduction in fuel consumption of 5 percent, then the effect of the strategy is a change in energy efficiency of automobiles to ((1-.25)*(1-.05)=) 0.71 times that shown in the base case.

Where measures may affect the same technologies, then the most effective of the two measures for any particular mode and year is selected. For example, if a strategy consists of two measures—one regulating new vehicle fuel economy and one taxing vehicles with poor fuel economy—then the one leading to the greatest energy savings is used.

B.4 Technology penetration

In some cases, energy saving or emission reducing measures only apply to new situations. For example, new emissions control technologies may only be applicable to new automobiles, not to automobiles already on the road. In these cases, the penetration of the technology over time is considered in developing estimates of the effects of the measures. Where the measure affects automobiles, the MENY estimates of fleet turnover rate and vehicle demand, as presented in the reference scenario from the MENY Energy Demand Model are used. This model keeps track of automobiles by vintage, and allows estimation of how many automobiles in service in a given year are of what age, and have what average fuel economy rating.

Table B-4

Base case scenario

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Demand for Transportation (A) Units	1988	1990	1995	2000	2005	Vehicle Loading (B) Units	1988	1990	1995	2000	2005
1	INTER-CITY	PUBLIC	RAIL	DIESEL	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
2	INTER-CITY	PUBLIC	BUS	DIESEL	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
3	INTER-CITY	PUBLIC	BUS	GASOLINE	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	dimensionless	1.000	1.000	1.000	1.000	1.000
4	INTER-CITY	PUBLIC	INTRA-AIR	TURBO	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
5	INTER-CITY	PUBLIC	EXTRA-AIR	TURBO	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	dimensionless	1.000	1.000	1.000	1.000	1.000
6	INTER-CITY	PRIVATE	AUTO	GASOLINE	pass.km/a	5.90E+10	6.12E+10	6.82E+10	7.30E+10	7.93E+10	pass/veh	1.856	1.800	1.800	1.800	1.800
7	INTER-CITY	PRIVATE	AUTO	DIESEL	pass.km/a	9.72E+08	1.40E+09	3.45E+09	6.40E+09	9.35E+09	pass/veh	1.856	1.800	1.800	1.800	1.800
8	INTER-CITY	PRIVATE	LIGHT TRUCK	GASOLINE	veh.km/a	3.98E+09	4.10E+09	4.71E+09	5.41E+09	6.22E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
9	INTER-CITY	PRIVATE	LIGHT TRUCK	DIESEL	veh.km/a	1.62E+08	1.72E+08	1.98E+08	2.27E+08	2.61E+08	dimensionless	1.000	1.000	1.000	1.000	1.000
10	INTER-CITY	GENERAL FREIGHT	TRUCK	GASOLINE	t.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
11	INTER-CITY	GENERAL FREIGHT	TRUCK	DIESEL	t.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
12	INTER-CITY	GENERAL FREIGHT	RAIL	DIESEL	t.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
13	INTER-CITY	GENERAL FREIGHT	MARINE	DIESEL	t.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
14	INTER-CITY	GENERAL FREIGHT	MARINE	HEAVY FO	t.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
15	INTER-CITY	GENERAL FREIGHT	MARINE	LIGHT FO	t.km/a						dimensionless	1.000	1.000	1.000	1.000	1.000
16	INTER-CITY	GENERAL FREIGHT	MARINE	KEROSENE	t.km/a						dimensionless	1.000	1.000	1.000	1.000	1.000
17	INTER-CITY	GENERAL FREIGHT	MARINE	COAL	t.km/a						dimensionless	1.000	1.000	1.000	1.000	1.000
18	INTER-CITY	SPECIFIC FREIGHT	RAIL	DIESEL	t.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
19	INTER-CITY	SPECIFIC FREIGHT	MARINE	DIESEL	t.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
20	INTER-CITY	SPECIFIC FREIGHT	MARINE	HEAVY FO	t.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
21	INTER-CITY	SPECIFIC FREIGHT	MARINE	LIGHT FO	t.km/a						dimensionless	1.000	1.000	1.000	1.000	1.000
22	INTER-CITY	SPECIFIC FREIGHT	MARINE	KEROSENE	t.km/a						dimensionless	1.000	1.000	1.000	1.000	1.000
23	INTER-CITY	SPECIFIC FREIGHT	MARINE	COAL	t.km/a						dimensionless	1.000	1.000	1.000	1.000	1.000
24	URBAN	PUBLIC	STREETCAR&SUBWAY	ELECTRICITY	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
25	URBAN	PUBLIC	GO-TRAIN	DIESEL	pass./a	2.84E+07	2.95E+07	3.30E+07	3.58E+07	3.91E+07	pass./veh.km	1.768	1.768	1.768	1.768	1.768
26	URBAN	PUBLIC	BUS	DIESEL	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.74E+09	4.10E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
27	URBAN	PUBLIC	BUS	GASOLINE	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.31E+06	4.73E+06	dimensionless	1.000	1.000	1.000	1.000	1.000
28	URBAN	PRIVATE PASSENGER	AUTO	ELECTRICITY	pass.km/a	2.16E+06	4.60E+05	5.54E+06	1.74E+07	3.29E+07	pass/veh	1.468	1.400	1.400	1.400	1.400
29	URBAN	PRIVATE PASSENGER	AUTO	DIESEL	pass.km/a	4.40E+08	6.29E+08	1.54E+09	2.85E+09	4.14E+09	pass/veh	1.468	1.400	1.400	1.400	1.400
30	URBAN	PRIVATE PASSENGER	AUTO	GASOLINE	pass.km/a	6.24E+10	6.46E+10	7.13E+10	7.59E+10	8.17E+10	pass/veh	1.468	1.400	1.400	1.400	1.400
31	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	GASOLINE	veh.km/a	3.77E+09	3.94E+09	4.52E+09	5.19E+09	5.98E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
32	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	DIESEL	veh.km/a	1.30E+08	1.66E+08	1.90E+08	2.18E+08	2.50E+08	dimensionless	1.000	1.000	1.000	1.000	1.000
33	URBAN	NON-FREIGHT	TRUCK	GASOLINE	veh.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
34	URBAN	NON-FREIGHT	TRUCK	DIESEL	veh.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	dimensionless	1.000	1.000	1.000	1.000	1.000
35	URBAN	FREIGHT	TRUCK	GASOLINE	t.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
36	URBAN	FREIGHT	TRUCK	DIESEL	t.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
37	AVIATION	GENERAL	AIRPLANE	TURBO	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
38	AVIATION	GENERAL	AIRPLANE	AVIATION GAS	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
39	AVIATION	GOVERNMENT	AIRPLANE	TURBO	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
40	AVIATION	GOVERNMENT	AIRPLANE	AVIATION GAS	MJ/a						dimensionless	1.000	1.000	1.000	1.000	1.000
41	OTHER	PRIVATE	MOTORCYCLES	GASOLINE	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
42	OTHER	OTHER	SCHOOL BUSES	GASOLINE	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
43	OTHER	PRIVATE	LEISURE VEHICLES	GASOLINE	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
	TOTAL															

Table B-4

Base case scenario

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Vehicle Demand (C) Units	1988	1990	1995	2000	2005	Vehicle Efficiency (D) Units	1988	1990	1995	2000	2005
1	INTER-CITY	PUBLIC	RAIL	DIESEL	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.733	1.733	1.733	1.733	1.733
2	INTER-CITY	PUBLIC	BUS	DIESEL	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	0.869	0.869	0.869	0.869	0.869
3	INTER-CITY	PUBLIC	BUS	GASOLINE	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	0.917	0.917	0.917	0.917	0.917
4	INTER-CITY	PUBLIC	INTRA-AIR	TURBO	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.591	4.591	4.591	4.591	4.591
5	INTER-CITY	PUBLIC	EXTRA-AIR	TURBO	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6384.4	6384.4	6384.4	6384.4	6384.4
6	INTER-CITY	PRIVATE	AUTO	GASOLINE	veh.km/a	3.18E+10	3.40E+10	3.79E+10	4.05E+10	4.41E+10	MJ/veh.km	3.093	3.012	2.942	2.766	2.663
7	INTER-CITY	PRIVATE	AUTO	DIESEL	veh.km/a	5.24E+08	7.80E+08	1.91E+09	3.56E+09	5.19E+09	MJ/veh.km	1.304	1.223	1.128	1.086	1.073
8	INTER-CITY	PRIVATE	LIGHT TRUCK	GASOLINE	veh.km/a	3.98E+09	4.10E+09	4.71E+09	5.41E+09	6.22E+09	MJ/veh.km	5.855	5.738	5.407	5.090	4.801
9	INTER-CITY	PRIVATE	LIGHT TRUCK	DIESEL	veh.km/a	1.62E+08	1.72E+08	1.98E+08	2.27E+08	2.61E+08	MJ/veh.km	5.079	4.927	4.643	4.371	4.119
10	INTER-CITY	GENERAL FREIGHT	TRUCK	GASOLINE	t.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/t.km	5.166	5.063	4.767	4.649	4.534
11	INTER-CITY	GENERAL FREIGHT	TRUCK	DIESEL	t.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/t.km	1.817	1.763	1.593	1.515	1.441
12	INTER-CITY	GENERAL FREIGHT	RAIL	DIESEL	t.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/t.km	0.242	0.237	0.225	0.214	0.204
13	INTER-CITY	GENERAL FREIGHT	MARINE	DIESEL	t.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/t.km	0.213	0.204	0.185	0.180	0.175
14	INTER-CITY	GENERAL FREIGHT	MARINE	HEAVY FO	t.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/t.km	0.430	0.430	0.430	0.430	0.430
15	INTER-CITY	GENERAL FREIGHT	MARINE	LIGHT FO	t.km/a						MJ/t.km	0.430	0.430	0.430	0.430	0.430
16	INTER-CITY	GENERAL FREIGHT	MARINE	KEROSENE	t.km/a						MJ/t.km	0.430	0.430	0.430	0.430	0.430
17	INTER-CITY	GENERAL FREIGHT	MARINE	COAL	t.km/a						MJ/t.km	0.430	0.430	0.430	0.430	0.430
18	INTER-CITY	SPECIFIC FREIGHT	RAIL	DIESEL	t.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/t.km	0.242	0.237	0.225	0.214	0.204
19	INTER-CITY	SPECIFIC FREIGHT	MARINE	DIESEL	t.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/t.km	0.253	0.243	0.220	0.214	0.209
20	INTER-CITY	SPECIFIC FREIGHT	MARINE	HEAVY FO	t.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/t.km	0.000	0.000	0.000	0.000	0.000
21	INTER-CITY	SPECIFIC FREIGHT	MARINE	LIGHT FO	t.km/a						MJ/t.km	0.000	0.000	0.000	0.000	0.000
22	INTER-CITY	SPECIFIC FREIGHT	MARINE	KEROSENE	t.km/a						MJ/t.km	0.000	0.000	0.000	0.000	0.000
23	INTER-CITY	SPECIFIC FREIGHT	MARINE	COAL	t.km/a						MJ/t.km	0.000	0.000	0.000	0.000	0.000
24	URBAN	PUBLIC	STREETCAR&SUBWAY	ELECTRICITY	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	0.451	0.449	0.445	0.441	0.436
25	URBAN	PUBLIC	GO-TRAIN	DIESEL	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	60.025	59.080	56.783	54.575	52.453
26	URBAN	PUBLIC	BUS	DIESEL	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.74E+09	4.10E+09	MJ/pass.km	2.109	2.109	2.109	2.109	2.109
27	URBAN	PUBLIC	BUS	GASOLINE	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.31E+06	4.73E+06	MJ/pass.km	2.227	2.227	2.227	2.227	2.227
28	URBAN	PRIVATE PASSENGER	AUTO	ELECTRICITY	veh.km/a	1.47E+06	3.29E+05	3.96E+06	1.25E+07	2.35E+07	MJ/veh.km	0.592	3.284	1.565	1.940	2.009
29	URBAN	PRIVATE PASSENGER	AUTO	DIESEL	veh.km/a	3.00E+08	4.49E+08	1.10E+09	2.03E+09	2.96E+09	MJ/veh.km	3.957	3.743	3.433	3.293	3.234
30	URBAN	PRIVATE PASSENGER	AUTO	GASOLINE	veh.km/a	4.25E+10	4.61E+10	5.09E+10	5.42E+10	5.84E+10	MJ/veh.km	4.585	4.503	4.427	4.163	3.998
31	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	GASOLINE	veh.km/a	3.77E+09	3.94E+09	4.52E+09	5.19E+09	5.98E+09	MJ/veh.km	5.829	5.738	5.407	5.090	4.801
32	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	DIESEL	veh.km/a	1.30E+08	1.66E+08	1.90E+08	2.18E+08	2.50E+08	MJ/veh.km	5.011	4.927	4.643	4.371	4.119
33	URBAN	NON-FREIGHT	TRUCK	GASOLINE	veh.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	MJ/veh.km	7.245	7.133	6.782	6.610	6.452
34	URBAN	NON-FREIGHT	TRUCK	DIESEL	veh.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	MJ/veh.km	5.664	5.569	5.427	5.171	4.907
35	URBAN	FREIGHT	TRUCK	GASOLINE	t.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/t.km	4.190	4.124	3.923	3.828	3.730
36	URBAN	FREIGHT	TRUCK	DIESEL	t.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/t.km	10.298	10.104	9.853	9.378	8.899
37	AVIATION	GENERAL	AIRPLANE	TURBO	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
38	AVIATION	GENERAL	AIRPLANE	AVIATION GAS	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
39	AVIATION	GOVERNMENT	AIRPLANE	TURBO	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
40	AVIATION	GOVERNMENT	AIRPLANE	AVIATION GAS	MJ/a						dimensionless	1.000	1.000	1.000	1.000	1.000
41	OTHER	PRIVATE	MOTORCYCLES	GASOLINE	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
42	OTHER	OTHER	SCHOOL BUSES	GASOLINE	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	dimensionless	1.000	1.000	1.000	1.000	1.000
43	OTHER	PRIVATE	LEISURE VEHICLES	GASOLINE	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	dimensionless	1.000	1.000	1.000	1.000	1.000
	TOTAL															

Table B-4

Base case scenario

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Energy Use (E) 1988	1990	1995	2000	2005
1	INTER-CITY	PUBLIC	RAIL	DIESEL	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09
2	INTER-CITY	PUBLIC	BUS	DIESEL	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09
3	INTER-CITY	PUBLIC	BUS	GASOLINE	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08
4	INTER-CITY	PUBLIC	INTRA-AIR	TURBO	MJ/a	1.98E+10	2.06E+10	2.32E+10	2.52E+10	2.78E+10
5	INTER-CITY	PUBLIC	EXTRA-AIR	TURBO	MJ/a	3.15E+10	3.20E+10	3.74E+10	4.00E+10	4.57E+10
6	INTER-CITY	PRIVATE	AUTO	GASOLINE	MJ/a	9.83E+10	1.02E+11	1.11E+11	1.12E+11	1.17E+11
7	INTER-CITY	PRIVATE	AUTO	DIESEL	MJ/a	6.83E+08	9.54E+08	2.16E+09	3.86E+09	5.57E+09
8	INTER-CITY	PRIVATE	LIGHT TRUCK	GASOLINE	MJ/a	2.33E+10	2.35E+10	2.55E+10	2.75E+10	2.99E+10
9	INTER-CITY	PRIVATE	LIGHT TRUCK	DIESEL	MJ/a	8.20E+08	8.49E+08	9.19E+08	9.92E+08	1.07E+09
10	INTER-CITY	GENERAL FREIGHT	TRUCK	GASOLINE	MJ/a	4.11E+10	4.15E+10	4.43E+10	5.07E+10	5.66E+10
11	INTER-CITY	GENERAL FREIGHT	TRUCK	DIESEL	MJ/a	4.00E+10	4.14E+10	4.75E+10	5.73E+10	6.25E+10
12	INTER-CITY	GENERAL FREIGHT	RAIL	DIESEL	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10
13	INTER-CITY	GENERAL FREIGHT	MARINE	DIESEL	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09
14	INTER-CITY	GENERAL FREIGHT	MARINE	HEAVY FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09
15	INTER-CITY	GENERAL FREIGHT	MARINE	LIGHT FO	MJ/a					
16	INTER-CITY	GENERAL FREIGHT	MARINE	KEROSENE	MJ/a					
17	INTER-CITY	GENERAL FREIGHT	MARINE	COAL	MJ/a					
18	INTER-CITY	SPECIFIC FREIGHT	RAIL	DIESEL	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09
19	INTER-CITY	SPECIFIC FREIGHT	MARINE	DIESEL	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09
20	INTER-CITY	SPECIFIC FREIGHT	MARINE	HEAVY FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03
21	INTER-CITY	SPECIFIC FREIGHT	MARINE	LIGHT FO	MJ/a					
22	INTER-CITY	SPECIFIC FREIGHT	MARINE	KEROSENE	MJ/a					
23	INTER-CITY	SPECIFIC FREIGHT	MARINE	COAL	MJ/a					
24	URBAN	PUBLIC	STREETCAR&SUBWAY	ELECTRICITY	MJ/a	1.22E+09	1.26E+09	1.40E+09	1.50E+09	1.63E+09
25	URBAN	PUBLIC	GO-TRAIN	DIESEL	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09
26	URBAN	PUBLIC	BUS	DIESEL	MJ/a	6.27E+09	6.51E+09	7.29E+09	7.90E+09	8.64E+09
27	URBAN	PUBLIC	BUS	GASOLINE	MJ/a	7.52E+06	7.83E+06	8.81E+06	9.59E+06	1.05E+07
28	URBAN	PRIVATE PASSENGER	AUTO	ELECTRICITY	MJ/a	8.70E+05	1.08E+06	6.19E+06	2.42E+07	4.73E+07
29	URBAN	PRIVATE PASSENGER	AUTO	DIESEL	MJ/a	1.19E+09	1.68E+09	3.77E+09	6.70E+09	9.57E+09
30	URBAN	PRIVATE PASSENGER	AUTO	GASOLINE	MJ/a	1.95E+11	2.08E+11	2.25E+11	2.26E+11	2.33E+11
31	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	GASOLINE	MJ/a	2.20E+10	2.26E+10	2.45E+10	2.64E+10	2.87E+10
32	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	DIESEL	MJ/a	6.54E+08	8.16E+08	8.83E+08	9.53E+08	1.03E+09
33	URBAN	NON-FREIGHT	TRUCK	GASOLINE	MJ/a	3.48E+10	3.57E+10	3.52E+10	3.47E+10	3.25E+10
34	URBAN	NON-FREIGHT	TRUCK	DIESEL	MJ/a	1.50E+09	1.85E+09	2.92E+09	3.69E+09	4.14E+09
35	URBAN	FREIGHT	TRUCK	GASOLINE	MJ/a	1.29E+10	1.30E+10	1.24E+10	1.12E+10	9.51E+09
36	URBAN	FREIGHT	TRUCK	DIESEL	MJ/a	2.43E+10	2.51E+10	2.78E+10	3.16E+10	3.45E+10
37	AVIATION	GENERAL	AIRPLANE	TURBO	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09
38	AVIATION	GENERAL	AIRPLANE	AVIATION GAS	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09
39	AVIATION	GOVERNMENT	AIRPLANE	TURBO	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09
40	AVIATION	GOVERNMENT	AIRPLANE	AVIATION GAS	MJ/a					
41	OTHER	PRIVATE	MOTORCYCLES	GASOLINE	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09
42	OTHER	OTHER	SCHOOL BUSES	GASOLINE	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09
43	OTHER	PRIVATE	LEISURE VEHICLES	GASOLINE	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10
	TOTAL				MJ/a	6.15E+11	6.41E+11	7.02E+11	7.44E+11	7.94E+11

Table B-5

Emission factors by pollutant and transportation mode

					CO2 Emissions Factors (F)						SO2 Emissions Factors (F)					
Number	Spatial	Sector	Mode	Fuel type	Units	1988	1990	1995	2000	2005	Units	1988	1990	1995	2000	2005
1	INTER-CITY	PUBLIC	RAIL	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.11	0.11	0.11	0.11	0.11
2	INTER-CITY	PUBLIC	BUS	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.46	0.46	0.46	0.46	0.46
3	INTER-CITY	PUBLIC	BUS	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.44	0.44	0.44	0.44	0.44
4	INTER-CITY	PUBLIC	INTRA-AIR	TURBO	g/MJ	70.83	70.83	70.83	70.83	70.83	g/MJ	0.003	0.003	0.003	0.003	0.003
5	INTER-CITY	PUBLIC	EXTRA-AIR	TURBO	g/MJ	70.83	70.83	70.83	70.83	70.83	g/MJ	0.003	0.003	0.003	0.003	0.003
6	INTER-CITY	PRIVATE	AUTO	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
7	INTER-CITY	PRIVATE	AUTO	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.15	0.15	0.15	0.15	0.15
8	INTER-CITY	PRIVATE	LIGHT TRUCK	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
9	INTER-CITY	PRIVATE	LIGHT TRUCK	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.15	0.15	0.15	0.15	0.15
10	INTER-CITY	GENERAL FREIGHT	TRUCK	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
11	INTER-CITY	GENERAL FREIGHT	TRUCK	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.15	0.15	0.15	0.15	0.15
12	INTER-CITY	GENERAL FREIGHT	RAIL	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.11	0.11	0.11	0.11	0.11
13	INTER-CITY	GENERAL FREIGHT	MARINE	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.21	0.21	0.21	0.21	0.21
14	INTER-CITY	GENERAL FREIGHT	MARINE	HEAVY FO	g/MJ	80.65	80.65	80.65	80.65	80.65	g/MJ	0.69	0.69	0.69	0.69	0.69
15	INTER-CITY	GENERAL FREIGHT	MARINE	LIGHT FO	g/MJ	73.11	73.11	73.11	73.11	73.11	g/MJ	0.69	0.69	0.69	0.69	0.69
16	INTER-CITY	GENERAL FREIGHT	MARINE	KEROSENE		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
17	INTER-CITY	GENERAL FREIGHT	MARINE	COAL		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
18	INTER-CITY	SPECIFIC FREIGHT	RAIL	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.11	0.11	0.11	0.11	0.11
19	INTER-CITY	SPECIFIC FREIGHT	MARINE	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.21	0.21	0.21	0.21	0.21
20	INTER-CITY	SPECIFIC FREIGHT	MARINE	HEAVY FO	g/MJ	80.65	80.65	80.65	80.65	80.65	g/MJ	0.69	0.69	0.69	0.69	0.69
21	INTER-CITY	SPECIFIC FREIGHT	MARINE	LIGHT FO	g/MJ	73.11	73.11	73.11	73.11	73.11	g/MJ	0.69	0.69	0.69	0.69	0.69
22	INTER-CITY	SPECIFIC FREIGHT	MARINE	KEROSENE		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
23	INTER-CITY	SPECIFIC FREIGHT	MARINE	COAL		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
24	URBAN	PUBLIC	STREETCAR&SUBWAY	ELECTRICITY		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
25	URBAN	PUBLIC	GO-TRAIN	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.11	0.11	0.11	0.11	0.11
26	URBAN	PUBLIC	BUS	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.46	0.46	0.46	0.46	0.46
27	URBAN	PUBLIC	BUS	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.44	0.44	0.44	0.44	0.44
28	URBAN	PRIVATE PASSENGER	AUTO	ELECTRICITY		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
29	URBAN	PRIVATE PASSENGER	AUTO	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.15	0.15	0.15	0.15	0.15
30	URBAN	PRIVATE PASSENGER	AUTO	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
31	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
32	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.15	0.15	0.15	0.15	0.15
33	URBAN	NON-FREIGHT	TRUCK	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
34	URBAN	NON-FREIGHT	TRUCK	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.15	0.15	0.15	0.15	0.15
35	URBAN	FREIGHT	TRUCK	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
36	URBAN	FREIGHT	TRUCK	DIESEL	g/MJ	70.68	70.68	70.68	70.68	70.68	g/MJ	0.15	0.15	0.15	0.15	0.15
37	AVIATION	GENERAL	AIRPLANE	TURBO	g/MJ	70.83	70.83	70.83	70.83	70.83	g/MJ	0.003	0.003	0.003	0.003	0.003
38	AVIATION	GENERAL	AIRPLANE	AVIATION GAS	g/MJ	75.92	75.92	75.92	75.92	75.92	g/MJ	0.003	0.003	0.003	0.003	0.003
39	AVIATION	GOVERNMENT	AIRPLANE	TURBO	g/MJ	70.83	70.83	70.83	70.83	70.83	g/MJ	0.003	0.003	0.003	0.003	0.003
40	AVIATION	GOVERNMENT	AIRPLANE	AVIATION GAS	g/MJ	75.92	75.92	75.92	75.92	75.92	g/MJ	0.003	0.003	0.003	0.003	0.003
41	OTHER	PRIVATE	MOTORCYCLES	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.05	0.05	0.05	0.05	0.05
42	OTHER	OTHER	SCHOOL BUSES	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02
43	OTHER	PRIVATE	LEISURE VEHICLES	GASOLINE	g/MJ	67.97	67.97	67.97	67.97	67.97	g/MJ	0.02	0.02	0.02	0.02	0.02

Note:

"Blank" indicates no data.

Table B-5 (continued)

Emission factors by pollutant and transportation mode

Number	Spatial	Sector	Mode	Fuel type	NOx Emissions Factors (F)						VOCs Emissions Factors (F)					
					Units	1988	1990	1995	2000	2005	Units	1988	1990	1995	2000	2005
1	INTER-CITY	PUBLIC	RAIL	DIESEL	g/MJ	1.44	1.44	1.44	1.44	1.44	g/MJ	0.07	0.07	0.07	0.07	0.07
2	INTER-CITY	PUBLIC	BUS	DIESEL	g/pass.km	3.53	2.92	2.15	1.38	1.30	g/pass.km	0.38	0.28	0.25	0.23	0.22
3	INTER-CITY	PUBLIC	BUS	GASOLINE	g/pass.km	8.42	7.63	6.91	6.19	6.10	g/pass.km	9.98	5.81	4.96	4.12	3.97
4	INTER-CITY	PUBLIC	INTRA-AIR	TURBO	g/MJ	0.03	0.03	0.03	0.03	0.03	g/MJ	0.04	0.04	0.04	0.04	0.04
5	INTER-CITY	PUBLIC	EXTRA-AIR	TURBO	g/MJ	0.03	0.03	0.03	0.03	0.03	g/MJ	0.04	0.04	0.04	0.04	0.04
6	INTER-CITY	PRIVATE	AUTO	GASOLINE	g/veh.km	1.97	1.26	0.95	0.63	0.60	g/veh.km	2.30	1.73	1.38	1.03	0.99
7	INTER-CITY	PRIVATE	AUTO	DIESEL	g/veh.km	1.29	1.14	1.02	0.89	0.90	g/veh.km	0.34	0.34	0.32	0.30	0.31
8	INTER-CITY	PRIVATE	LIGHT TRUCK	GASOLINE	g/veh.km	2.19	1.48	1.20	0.92	0.86	g/veh.km	3.19	2.15	1.71	1.26	1.19
9	INTER-CITY	PRIVATE	LIGHT TRUCK	DIESEL	g/veh.km	1.29	1.14	1.02	0.89	0.90	g/veh.km	0.34	0.34	0.32	0.30	0.31
10	INTER-CITY	GENERAL FREIGHT	TRUCK	GASOLINE	g/t.km	0.14	0.13	0.11	0.10	0.10	g/t.km	0.16	0.10	0.08	0.07	0.07
11	INTER-CITY	GENERAL FREIGHT	TRUCK	DIESEL	g/t.km	2.40	1.99	1.46	0.94	0.88	g/t.km	0.26	0.19	0.17	0.16	0.15
12	INTER-CITY	GENERAL FREIGHT	RAIL	DIESEL	g/MJ	1.44	1.44	1.44	1.44	1.44	g/MJ	0.07	0.07	0.07	0.07	0.07
13	INTER-CITY	GENERAL FREIGHT	MARINE	DIESEL	g/MJ	0.80	0.80	0.80	0.80	0.80	g/MJ	0.18	0.18	0.18	0.18	0.18
14	INTER-CITY	GENERAL FREIGHT	MARINE	HEAVY FO	g/MJ	0.10	0.10	0.10	0.10	0.10	g/MJ	0.01	0.01	0.01	0.01	0.01
15	INTER-CITY	GENERAL FREIGHT	MARINE	LIGHT FO	g/MJ	0.10	0.10	0.10	0.10	0.10	g/MJ	0.01	0.01	0.01	0.01	0.01
16	INTER-CITY	GENERAL FREIGHT	MARINE	KEROSENE												
17	INTER-CITY	GENERAL FREIGHT	MARINE	COAL												
18	INTER-CITY	SPECIFIC FREIGHT	RAIL	DIESEL	g/MJ	1.44	1.44	1.44	1.44	1.44	g/MJ	0.07	0.07	0.07	0.07	0.07
19	INTER-CITY	SPECIFIC FREIGHT	MARINE	DIESEL	g/MJ	0.80	0.80	0.80	0.80	0.80	g/MJ	0.18	0.18	0.18	0.18	0.18
20	INTER-CITY	SPECIFIC FREIGHT	MARINE	HEAVY FO	g/MJ	0.10	0.10	0.10	0.10	0.10	g/MJ	0.01	0.01	0.01	0.01	0.01
21	INTER-CITY	SPECIFIC FREIGHT	MARINE	LIGHT FO	g/MJ	0.10	0.10	0.10	0.10	0.10	g/MJ	0.01	0.01	0.01	0.01	0.01
22	INTER-CITY	SPECIFIC FREIGHT	MARINE	KEROSENE												
23	INTER-CITY	SPECIFIC FREIGHT	MARINE	COAL												
24	URBAN	PUBLIC	STREETCAR&SUBWAY	ELECTRICITY		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
25	URBAN	PUBLIC	GO-TRAIN	DIESEL	g/MJ	1.44	1.44	1.44	1.44	1.44	g/MJ	0.07	0.07	0.07	0.07	0.07
26	URBAN	PUBLIC	BUS	DIESEL	g/pass.km	3.53	2.92	2.15	1.38	1.30	g/pass.km	0.38	0.28	0.25	0.23	0.22
27	URBAN	PUBLIC	BUS	GASOLINE	g/pass.km	8.42	7.63	6.91	6.19	6.10	g/pass.km	9.98	5.81	4.96	4.12	3.97
28	URBAN	PRIVATE PASSENGER	AUTO	ELECTRICITY		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
29	URBAN	PRIVATE PASSENGER	AUTO	DIESEL	g/veh.km	1.29	1.14	1.02	0.89	0.90	g/veh.km	0.34	0.34	0.32	0.30	0.31
30	URBAN	PRIVATE PASSENGER	AUTO	GASOLINE	g/veh.km	1.97	1.26	0.95	0.63	0.60	g/veh.km	2.30	1.73	1.38	1.03	0.99
31	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	GASOLINE	g/veh.km	2.19	1.48	1.20	0.92	0.86	g/veh.km	3.19	2.15	1.71	1.26	1.19
32	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	DIESEL	g/veh.km	1.29	1.14	1.02	0.89	0.90	g/veh.km	0.34	0.34	0.32	0.30	0.31
33	URBAN	NON-FREIGHT	TRUCK	GASOLINE	g/veh.km	2.93	2.00	1.80	1.60	1.51	g/veh.km	4.75	3.20	2.26	1.31	1.24
34	URBAN	NON-FREIGHT	TRUCK	DIESEL	g/veh.km	1.29	1.14	1.02	0.89	0.90	g/veh.km	0.34	0.34	0.32	0.30	0.31
35	URBAN	FREIGHT	TRUCK	GASOLINE	g/t.km	0.14	0.13	0.11	0.10	0.10	g/t.km	0.16	0.10	0.08	0.07	0.07
36	URBAN	FREIGHT	TRUCK	DIESEL	g/t.km	2.40	1.99	1.46	0.94	0.88	g/t.km	0.26	0.19	0.17	0.16	0.15
37	AVIATION	GENERAL	AIRPLANE	TURBO	g/MJ	0.03	0.03	0.03	0.03	0.03	g/MJ	0.04	0.04	0.04	0.04	0.04
38	AVIATION	GENERAL	AIRPLANE	AVIATION GAS	g/MJ	0.03	0.03	0.03	0.03	0.03	g/MJ	0.04	0.04	0.04	0.04	0.04
39	AVIATION	GOVERNMENT	AIRPLANE	TURBO	g/MJ	0.03	0.03	0.03	0.03	0.03	g/MJ	0.04	0.04	0.04	0.04	0.04
40	AVIATION	GOVERNMENT	AIRPLANE	AVIATION GAS	g/MJ	0.03	0.03	0.03	0.03	0.03	g/MJ	0.04	0.04	0.04	0.04	0.04
41	OTHER	PRIVATE	MOTORCYCLES	GASOLINE	g/MJ	1.21	0.77	0.58	0.39	0.37	g/MJ	1.41	1.06	1.23	0.63	0.61
42	OTHER	OTHER	SCHOOL BUSES	GASOLINE	g/MJ	0.47	0.42	0.38	0.34	0.34	g/MJ	0.55	0.32	0.44	0.23	0.22
43	OTHER	PRIVATE	LEISURE VEHICLES	GASOLINE	g/MJ	0.48	0.33	0.30	0.26	0.25	g/MJ	0.78	0.53	0.65	0.22	0.20

Note:

"Blank" indicates no data.

Table B-5 (continued)

Emission factors by pollutant and transportation mode

Number	Spatial	Sector	Mode	Fuel type	Particulate Emissions Factors (F)						CO Emissions Factors (F)					
					Units	1988	1990	1995	2000	2005	Units	1988	1990	1995	2000	2005
1	INTER-CITY	PUBLIC	RAIL	DIESEL	g/MJ	0.08	0.08	0.08	0.08	0.08	g/MJ	0.57	0.57	0.57	0.57	0.57
2	INTER-CITY	PUBLIC	BUS	DIESEL	g/pass.km	0.19	0.19	0.19	0.19	0.19	g/pass.km	1.59	1.37	1.29	1.22	1.21
3	INTER-CITY	PUBLIC	BUS	GASOLINE	g/pass.km	1.25	1.25	1.25	1.25	1.25	g/pass.km	112.38	64.16	48.47	32.79	30.05
4	INTER-CITY	PUBLIC	INTRA-AIR	TURBO	g/MJ	0.00	0.00	0.00	0.00	0.00	g/MJ	0.11	0.11	0.11	0.11	0.11
5	INTER-CITY	PUBLIC	EXTRA-AIR	TURBO	g/MJ	0.00	0.00	0.00	0.00	0.00	g/MJ	0.11	0.11	0.11	0.11	0.11
6	INTER-CITY	PRIVATE	AUTO	GASOLINE	g/veh.km	0.34	0.34	0.34	0.34	0.34	g/veh.km	19.30	12.52	10.09	7.66	7.48
7	INTER-CITY	PRIVATE	AUTO	DIESEL	g/veh.km	0.45	0.45	0.45	0.45	0.45	g/veh.km	0.81	0.80	0.77	0.74	0.76
8	INTER-CITY	PRIVATE	LIGHT TRUCK	GASOLINE	g/veh.km	0.34	0.34	0.34	0.34	0.34	g/veh.km	25.11	17.38	14.21	11.03	10.53
9	INTER-CITY	PRIVATE	LIGHT TRUCK	DIESEL	g/veh.km	0.45	0.45	0.45	0.45	0.45	g/veh.km	0.81	0.80	0.77	0.74	0.76
10	INTER-CITY	GENERAL FREIGHT	TRUCK	GASOLINE	g/t.km	0.02	0.02	0.02	0.02	0.02	g/t.km	1.84	1.05	0.80	0.54	0.49
11	INTER-CITY	GENERAL FREIGHT	TRUCK	DIESEL	g/t.km	0.13	0.13	0.13	0.13	0.13	g/t.km	1.08	0.93	0.88	0.83	0.82
12	INTER-CITY	GENERAL FREIGHT	RAIL	DIESEL	g/MJ	0.08	0.08	0.08	0.08	0.08	g/MJ	0.57	0.57	0.57	0.57	0.57
13	INTER-CITY	GENERAL FREIGHT	MARINE	DIESEL	g/MJ	0.05	0.05	0.05	0.05	0.05	g/MJ	0.34	0.34	0.34	0.34	0.34
14	INTER-CITY	GENERAL FREIGHT	MARINE	HEAVY FO	g/MJ	0.03	0.03	0.03	0.03	0.03		0.00	0.00	0.00	0.00	0.00
15	INTER-CITY	GENERAL FREIGHT	MARINE	LIGHT FO	g/MJ	0.03	0.03	0.03	0.03	0.03		0.00	0.00	0.00	0.00	0.00
16	INTER-CITY	GENERAL FREIGHT	MARINE	KEROSENE												
17	INTER-CITY	GENERAL FREIGHT	MARINE	COAL												
18	INTER-CITY	SPECIFIC FREIGHT	RAIL	DIESEL	g/MJ	0.08	0.08	0.08	0.08	0.08	g/MJ	0.57	0.57	0.57	0.57	0.57
19	INTER-CITY	SPECIFIC FREIGHT	MARINE	DIESEL	g/MJ	0.05	0.05	0.05	0.05	0.05	g/MJ	0.34	0.34	0.34	0.34	0.34
20	INTER-CITY	SPECIFIC FREIGHT	MARINE	HEAVY FO	g/MJ	0.03	0.03	0.03	0.03	0.03		0.00	0.00	0.00	0.00	0.00
21	INTER-CITY	SPECIFIC FREIGHT	MARINE	LIGHT FO	g/MJ	0.03	0.03	0.03	0.03	0.03		0.00	0.00	0.00	0.00	0.00
22	INTER-CITY	SPECIFIC FREIGHT	MARINE	KEROSENE												
23	INTER-CITY	SPECIFIC FREIGHT	MARINE	COAL												
24	URBAN	PUBLIC	STREETCAR&SUBWAY	ELECTRICITY		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
25	URBAN	PUBLIC	GO-TRAIN	DIESEL	g/MJ	0.08	0.08	0.08	0.08	0.08	g/MJ	0.57	0.57	0.57	0.57	0.57
26	URBAN	PUBLIC	BUS	DIESEL	g/pass.km	0.19	0.19	0.19	0.19	0.19	g/pass.km	1.59	1.37	1.29	1.22	1.21
27	URBAN	PUBLIC	BUS	GASOLINE	g/pass.km	1.25	1.25	1.25	1.25	1.25	g/pass.km	112.38	64.16	48.47	32.79	30.05
28	URBAN	PRIVATE PASSENGER	AUTO	ELECTRICITY		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
29	URBAN	PRIVATE PASSENGER	AUTO	DIESEL	g/veh.km	0.45	0.45	0.45	0.45	0.45	g/veh.km	0.81	0.80	0.77	0.74	0.76
30	URBAN	PRIVATE PASSENGER	AUTO	GASOLINE	g/veh.km	0.34	0.34	0.34	0.34	0.34	g/veh.km	19.30	12.52	10.09	7.66	7.48
31	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	GASOLINE	g/veh.km	0.34	0.34	0.34	0.34	0.34	g/veh.km	25.11	17.38	14.21	11.03	10.53
32	URBAN	PRIVATE PASSENGER	LIGHT TRUCK	DIESEL	g/veh.km	0.45	0.45	0.45	0.45	0.45	g/veh.km	0.81	0.80	0.77	0.74	0.76
33	URBAN	NON-FREIGHT	TRUCK	GASOLINE	g/veh.km	0.34	0.34	0.34	0.34	0.34	g/veh.km	27.15	18.80	15.36	11.92	11.38
34	URBAN	NON-FREIGHT	TRUCK	DIESEL	g/veh.km	0.45	0.45	0.45	0.45	0.45	g/veh.km	0.81	0.80	0.77	0.74	0.76
35	URBAN	FREIGHT	TRUCK	GASOLINE	g/t.km	0.02	0.02	0.02	0.02	0.02	g/t.km	1.84	1.05	0.80	0.54	0.49
36	URBAN	FREIGHT	TRUCK	DIESEL	g/t.km	0.13	0.13	0.13	0.13	0.13	g/t.km	1.08	0.93	0.88	0.83	0.82
37	AVIATION	GENERAL	AIRPLANE	TURBO	g/MJ	0.00	0.00	0.00	0.00	0.00	g/MJ	0.11	0.11	0.11	0.11	0.11
38	AVIATION	GENERAL	AIRPLANE	AVIATION GAS	g/MJ	0.00	0.00	0.00	0.00	0.00	g/MJ	0.11	0.11	0.11	0.11	0.11
39	AVIATION	GOVERNMENT	AIRPLANE	TURBO	g/MJ	0.00	0.00	0.00	0.00	0.00	g/MJ	0.11	0.11	0.11	0.11	0.11
40	AVIATION	GOVERNMENT	AIRPLANE	AVIATION GAS	g/MJ	0.00	0.00	0.00	0.00	0.00	g/MJ	0.11	0.11	0.11	0.11	0.11
41	OTHER	PRIVATE	MOTORCYCLES	GASOLINE	g/MJ	0.21	0.21	0.21	0.21	0.21	g/MJ	11.82	7.67	6.18	4.69	4.58
42	OTHER	OTHER	SCHOOL BUSES	GASOLINE	g/MJ	0.07	0.07	0.07	0.07	0.07	g/MJ	6.23	3.56	2.69	1.82	1.87
43	OTHER	PRIVATE	LEISURE VEHICLES	GASOLINE	g/MJ	0.06	0.06	0.06	0.06	0.06	g/MJ	4.46	3.09	2.52	1.96	1.87

Note:

"Blank" indicates no data.

Table B-6
Base case emissions

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Tonnes of CO2 emissions(G) 1986	1990	1995	2000	2005	Units	Tonnes of SO2 emissions (G) 1986	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	180 342	187 375	211 120	229 560	252 729	tonnes	292	303	341	371	409
2	Inter-city	Public	Bus	Diesel	tonnes	94 572	94 612	106 605	115 920	127 614	tonnes	612	612	690	750	826
3	Inter-city	Public	Bus	Gasoline	tonnes	6 787	6 790	7 650	8 319	9 158	tonnes	44	44	50	54	59
4	Inter-city	Public	Intra-air	Turbo	tonnes	1 403 880	1 458 577	1 643 415	1 787 019	1 967 305	tonnes	69	71	80	87	96
5	Inter-city	Public	Extra-air	Turbo	tonnes	2 232 781	2 267 014	2 646 560	2 834 638	3 233 856	tonnes	109	111	129	139	158
6	Inter-city	Private	Auto	Gasoline	tonnes	6 663 943	6 960 600	7 572 372	7 619 954	7 973 422	tonnes	2 137	2 226	2 422	2 437	2 550
7	Inter-city	Private	Auto	Diesel	tonnes	48 290	67 438	152 604	272 976	393 984	tonnes	102	142	322	575	830
8	Inter-city	Private	Light truck	Gasoline	tonnes	1 564 182	1 599 428	1 730 171	1 870 270	2 030 337	tonnes	507	511	553	598	649
9	Inter-city	Private	Light truck	Diesel	tonnes	57 983	60 037	64 946	70 111	75 879	tonnes	122	127	137	148	160
10	Inter-city	General freight	Truck	Gasoline	tonnes	2 793 483	2 820 366	3 007 966	3 443 815	3 848 093	tonnes	893	902	962	1 101	1 231
11	Inter-city	General freight	Truck	Diesel	tonnes	2 825 701	2 925 785	3 356 961	4 050 227	4 419 731	tonnes	5 955	6 166	7 075	8 536	9 314
12	Inter-city	General freight	Rail	Diesel	tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080	tonnes	1 679	1 676	1 884	2 089	2 280
13	Inter-city	General freight	Marine	Diesel	tonnes	276 181	297 184	388 828	454 124	519 900	tonnes	817	879	1 151	1 344	1 538
14	Inter-city	General freight	Marine	Heavy FO	tonnes	501 341	476 603	443 478	531 097	623 454	tonnes	4 268	4 057	3 775	4 521	5 307
15	Inter-city	General freight	Marine	Light FO	tonnes						tonnes					
16	Inter-city	General freight	Marine	Kerosene	tonnes						tonnes					
17	Inter-city	General freight	Marine	Coal	tonnes						tonnes					
18	Inter-city	Specific freight	Rail	Diesel	tonnes	396 620	402 367	423 757	469 080	503 513	tonnes	642	650	685	758	814
19	Inter-city	Specific freight	Marine	Diesel	tonnes	519 888	554 396	626 499	651 106	684 243	tonnes	1 538	1 640	1 854	1 927	2 025
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	1	1	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes						tonnes					
22	Inter-city	Specific freight	Marine	Kerosene	tonnes						tonnes					
23	Inter-city	Specific freight	Marine	Coal	tonnes						tonnes					
24	Urban	Public	Streetcar&Subway	Electricity	tonnes						tonnes	110	113	121	126	133
25	Urban	Public	GO-Train	Diesel	tonnes	68 125	69 660	74 944	78 076	82 094	tonnes	2 867	2 978	3 333	3 612	3 952
26	Urban	Public	Bus	Diesel	tonnes	443 056	460 243	515 091	558 231	610 662	tonnes	3	3	4	4	5
27	Urban	Public	Bus	Gasoline	tonnes	511	532	599	652	716	tonnes					
28	Urban	Private passenger	Auto	Electricity	tonnes						tonnes	177	250	561	998	1 426
29	Urban	Private passenger	Auto	Diesel	tonnes	83 829	118 817	266 402	473 573	676 502	tonnes	4 234	4 515	4 900	4 904	5 073
30	Urban	Private passenger	Auto	Gasoline	tonnes	13 241 454	14 118 327	15 321 477	15 335 072	15 865 274	tonnes	477	491	532	575	624
31	Urban	Private passenger	Light truck	Gasoline	tonnes	1 493 131	1 536 705	1 662 322	1 796 926	1 950 716	tonnes	97	122	132	142	154
32	Urban	Private passenger	Light truck	Diesel	tonnes	46 205	57 682	62 400	67 361	72 904	tonnes	756	775	766	755	706
33	Urban	Non-freight	Truck	Gasoline	tonnes	2 363 984	2 424 810	2 394 365	2 361 485	2 208 632	tonnes	223	276	434	550	617
34	Urban	Non-freight	Truck	Diesel	tonnes	105 714	130 850	206 047	261 022	292 643	tonnes	281	283	269	243	207
35	Urban	Freight	Truck	Gasoline	tonnes	878 445	884 666	842 217	760 830	646 244	tonnes	3 619	3 742	4 145	4 709	5 135
36	Urban	Freight	Truck	Diesel	tonnes	1 717 010	1 775 824	1 966 817	2 234 458	2 436 450	tonnes	4	4	5	5	6
37	Aviation	General	Airplane	Turbo	tonnes	80 529	82 498	95 000	102 338	115 173	tonnes	7	8	9	9	11
38	Aviation	General	Airplane	Aviation gas	tonnes	163 162	167 148	192 469	207 351	233 355	tonnes	18	18	21	23	25
39	Aviation	Government	Airplane	Turbo	tonnes	363 667	372 563	428 995	462 166	520 114	tonnes					
40	Aviation	Government	Airplane	Aviation gas	tonnes						tonnes	31	33	39	46	53
41	Other	Private	Motorcycle	Gasoline	tonnes	43 361	46 202	54 063	63 308	74 106	tonnes	32	32	31	31	30
42	Other	Other	School bus	Gasoline	tonnes	97 408	96 592	94 580	92 609	90 685	tonnes	119	126	148	173	203
43	Other	Private	Leisure vehicle	Gasoline	tonnes	446 559	475 591	556 719	651 679	762 811						
	TOTAL					42 281 126	44 033 769	48 282 576	51 207 532	54 712 378		32 842	33 889	37 558	42 340	46 604

Table B-6
Base case emissions

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of NOx emissions (G) 1988	1990	1995	2000	2005	Unit	Tonnes of VOCs emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	3 668	3 811	4 293	4 668	5 140	tonnes	178	185	208	227	250
2	Inter-city	Public	Bus	Diesel	tonnes	5 436	4 502	3 731	2 599	2 696	tonnes	587	425	438	432	466
3	Inter-city	Public	Bus	Gasoline	tonnes	916	830	848	826	896	tonnes	1 086	632	609	549	583
4	Inter-city	Public	Intra-air	Turbo	tonnes	669	695	783	852	938	tonnes	765	795	896	974	1 072
5	Inter-city	Public	Extra-air	Turbo	tonnes	1 064	1 081	1 261	1 351	1 541	tonnes	0	0	0	0	0
6	Inter-city	Private	Auto	Gasoline	tonnes	62 626	42 841	35 781	25 536	26 433	tonnes	73 117	58 822	52 251	41 749	43 614
7	Inter-city	Private	Auto	Diesel	tonnes	676	889	1 943	3 165	4 674	tonnes	178	265	613	1 067	1 610
8	Inter-city	Private	Light truck	Gasoline	tonnes	8 717	6 069	5 649	4 974	5 351	tonnes	12 698	8 816	8 026	6 812	7 404
9	Inter-city	Private	Light truck	Diesel	tonnes	208	197	201	202	235	tonnes	55	59	63	68	81
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 099	1 026	1 053	1 108	1 251	tonnes	1 303	781	756	737	814
11	Inter-city	General freight	Truck	Diesel	tonnes	52 850	46 690	43 595	35 429	38 307	tonnes	5 705	4 408	5 120	5 895	6 626
12	Inter-city	General freight	Rail	Diesel	tonnes	21 125	21 078	23 694	26 278	28 676	tonnes	1 026	1 024	1 151	1 276	1 393
13	Inter-city	General freight	Marine	Diesel	tonnes	3 132	3 370	4 409	5 149	5 895	tonnes	714	769	1 005	1 174	1 344
14	Inter-city	General freight	Marine	Heavy FO	tonnes	651	619	576	690	810	tonnes	57	54	50	60	70
15	Inter-city	General freight	Marine	Light FO	tonnes						tonnes					
16	Inter-city	General freight	Marine	Kerosene	tonnes						tonnes					
17	Inter-city	General freight	Marine	Coal	tonnes						tonnes					
18	Inter-city	Specific freight	Rail	Diesel	tonnes	8 070	8 183	8 618	9 539	10 240	tonnes	392	397	418	463	497
19	Inter-city	Specific freight	Marine	Diesel	tonnes	5 895	6 286	7 104	7 383	7 758	tonnes	1 344	1 434	1 620	1 684	1 769
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes						tonnes					
22	Inter-city	Specific freight	Marine	Kerosene	tonnes						tonnes					
23	Inter-city	Specific freight	Marine	Coal	tonnes						tonnes					
24	Urban	Public	Streetcar&Subway	Electricity	tonnes						tonnes					
25	Urban	Public	GO-Train	Diesel	tonnes	1 385	1 417	1 524	1 588	1 670	tonnes	67	69	74	77	81
26	Urban	Public	Bus	Diesel	tonnes	10 489	9 019	7 425	5 155	5 313	tonnes	1 132	851	872	858	919
27	Urban	Public	Bus	Gasoline	tonnes	28	27	27	27	29	tonnes	34	20	20	18	19
28	Urban	Private passenger	Auto	Electricity	tonnes						tonnes					
29	Urban	Private passenger	Auto	Diesel	tonnes	387	512	1 114	1 811	2 664	tonnes	102	153	351	610	918
30	Urban	Private passenger	Auto	Gasoline	tonnes	83 703	58 114	48 111	34 137	35 027	tonnes	97 725	79 791	70 257	55 812	57 794
31	Urban	Private passenger	Light truck	Gasoline	tonnes	8 253	5 831	5 427	4 778	5 141	tonnes	12 022	8 470	7 711	6 544	7 114
32	Urban	Private passenger	Light truck	Diesel	tonnes	168	189	193	194	225	tonnes	44	56	61	65	78
33	Urban	Non-freight	Truck	Gasoline	tonnes	14 065	10 003	9 348	8 410	7 605	tonnes	22 802	16 004	11 711	6 885	6 245
34	Urban	Non-freight	Truck	Diesel	tonnes	341	379	545	636	759	tonnes	90	113	172	214	262
35	Urban	Freight	Truck	Gasoline	tonnes	426	395	358	297	255	tonnes	505	301	257	198	166
36	Urban	Freight	Truck	Diesel	tonnes	5 666	4 944	4 130	3 158	3 419	tonnes	612	467	485	525	591
37	Aviation	General	Airplane	Turbo	tonnes	38	39	45	49	55	tonnes	44	45	52	56	63
38	Aviation	General	Airplane	Aviation gas	tonnes	73	74	86	92	104	tonnes	83	85	98	105	119
39	Aviation	Government	Airplane	Turbo	tonnes	173	178	204	220	248	tonnes	198	203	234	252	284
40	Aviation	Government	Airplane	Aviation gas	tonnes						tonnes					
41	Other	Private	Motorcycle	Gasoline	tonnes	770	520	458	359	401	tonnes	899	720	982	588	661
42	Other	Other	School bus	Gasoline	tonnes	668	601	533	468	451	tonnes	792	457	609	311	293
43	Other	Private	Leisure vehicle	Gasoline	tonnes	3 160	2 297	2 420	2 518	2 782	tonnes	5 123	3 676	5 345	2 062	2 284
	TOTAL					306 597	242 704	225 490	193 646	206 987		241 480	190 347	172 516	138 347	145 485

Table B-6
Base case emissions

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of Particulate emissions (G) 1988	1990	1995	2000	2005	Units	Tonnes of CO emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	198	206	232	252	277	tonnes	1 466	1 524	1 717	1 867	2 055
2	Inter-city	Public	Bus	Diesel	tonnes	292	292	329	357	393	tonnes	2 444	2 107	2 244	2 299	2 511
3	Inter-city	Public	Bus	Gasoline	tonnes	136	136	153	167	184	tonnes	12 230	6 985	5 946	4 373	4 412
4	Inter-city	Public	Intra-air	Turbo	tonnes	56	58	65	71	78	tonnes	2 139	2 222	2 503	2 722	2 997
5	Inter-city	Public	Extra-air	Turbo	tonnes	89	90	105	112	128	tonnes	3 401	3 453	4 032	4 318	4 926
6	Inter-city	Private	Auto	Gasoline	tonnes	10 809	11 560	12 873	13 781	14 979	tonnes	613 547	425 693	382 036	310 483	329 531
7	Inter-city	Private	Auto	Diesel	tonnes	236	351	862	1 600	2 337	tonnes	424	624	1 474	2 632	3 947
8	Inter-city	Private	Light truck	Gasoline	tonnes	1 353	1 394	1 600	1 838	2 115	tonnes	99 950	71 265	66 867	59 628	65 518
9	Inter-city	Private	Light truck	Diesel	tonnes	73	78	89	102	117	tonnes	131	138	152	168	198
10	Inter-city	General freight	Truck	Gasoline	tonnes	163	168	190	224	256	tonnes	14 676	8 631	7 387	5 866	6 159
11	Inter-city	General freight	Truck	Diesel	tonnes	2 835	3 025	3 840	4 872	5 591	tonnes	23 765	21 851	26 219	31 339	35 684
12	Inter-city	General freight	Rail	Diesel	tonnes	1 140	1 137	1 278	1 418	1 547	tonnes	8 446	8 428	9 473	10 507	11 465
13	Inter-city	General freight	Marine	Diesel	tonnes	182	196	256	299	342	tonnes	1 332	1 434	1 876	2 191	2 508
14	Inter-city	General freight	Marine	Heavy FO	tonnes	179	170	158	189	222	tonnes					
15	Inter-city	General freight	Marine	Light FO	tonnes						tonnes					
16	Inter-city	General freight	Marine	Kerosene	tonnes						tonnes					
17	Inter-city	General freight	Marine	Coal	tonnes						tonnes					
18	Inter-city	Specific freight	Rail	Diesel	tonnes	435	442	465	515	553	tonnes	3 227	3 272	3 446	3 814	4 094
19	Inter-city	Specific freight	Marine	Diesel	tonnes	342	365	412	429	450	tonnes	2 508	2 675	3 023	3 141	3 301
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes					
21	Inter-city	Specific freight	Marine	Light FO	tonnes						tonnes					
22	Inter-city	Specific freight	Marine	Kerosene	tonnes						tonnes					
23	Inter-city	Specific freight	Marine	Coal	tonnes						tonnes					
24	Urban	Public	Streetcar&Subway	Electricity	tonnes						tonnes					
25	Urban	Public	GO-Train	Diesel	tonnes	75	76	82	86	90	tonnes	554	566	609	635	668
26	Urban	Public	Bus	Diesel	tonnes	563	584	654	709	775	tonnes	4 716	4 221	4 466	4 560	4 950
27	Urban	Public	Bus	Gasoline	tonnes	4	4	5	5	6	tonnes	379	226	192	141	142
28	Urban	Private passenger	Auto	Electricity	tonnes						tonnes					
29	Urban	Private passenger	Auto	Diesel	tonnes	135	202	494	915	1 332	tonnes	243	359	845	1 505	2 250
30	Urban	Private passenger	Auto	Gasoline	tonnes	14 446	15 681	17 310	18 423	19 849	tonnes	820 038	577 447	513 692	415 065	436 667
31	Urban	Private passenger	Light truck	Gasoline	tonnes	1 281	1 339	1 538	1 766	2 033	tonnes	94 632	68 470	64 245	57 290	62 948
32	Urban	Private passenger	Light truck	Diesel	tonnes	59	75	86	98	113	tonnes	106	132	146	161	190
33	Urban	Non-freight	Truck	Gasoline	tonnes	1 632	1 700	1 766	1 787	1 712	tonnes	130 332	94 025	79 771	62 652	57 312
34	Urban	Non-freight	Truck	Diesel	tonnes	119	150	242	321	380	tonnes	214	266	414	529	641
35	Urban	Freight	Truck	Gasoline	tonnes	63	65	65	60	52	tonnes	5 690	3 324	2 513	1 574	1 257
36	Urban	Freight	Truck	Diesel	tonnes	304	320	364	434	499	tonnes	2 548	2 314	2 484	2 793	3 185
37	Aviation	General	Airplane	Turbo	tonnes	3	3	4	4	5	tonnes	123	126	145	156	175
38	Aviation	General	Airplane	Aviation gas	tonnes	6	6	7	8	9	tonnes	232	238	274	295	332
39	Aviation	Government	Airplane	Turbo	tonnes	14	15	17	18	21	tonnes	554	568	653	704	792
40	Aviation	Government	Airplane	Aviation gas	tonnes						tonnes					
41	Other	Private	Motorcycle	Gasoline	tonnes	133	142	166	194	227	tonnes	7 545	5 213	4 917	4 370	4 995
42	Other	Other	School bus	Gasoline	tonnes	99	98	96	94	92	tonnes	8 925	5 052	3 738	2 475	2 222
43	Other	Private	Leisure vehicle	Gasoline	tonnes	367	391	457	535	626	tonnes	29 281	21 594	20 652	18 761	20 965
	TOTAL					37 820	40 520	46 261	51 685	57 391		1 895 797	1 344 440	1 218 153	1 019 012	1 078 999

Appendix C Review and evaluation of major measures

Appendix C.1 Automobile and light truck fuel economy

Many analysts have attempted to forecast the fuel efficiencies of tomorrow's automobiles. Predicting the impacts of technological advances is difficult, and the wide range of behavioural, economic and technological factors compound this difficulty. The following text discusses the use of the literature to arrive at estimates of future fuel efficiencies in automobiles.

C.1.1 Objective

A review of publications citing possible gains in automobile fuel efficiencies was undertaken in an attempt to reconcile the seemingly wide range of predictions cited. Point estimates of future fuel efficiencies were desired. These would be adopted as possible Corporate Average Fuel Economy (CAFE) standards in several energy and emissions reduction strategies.

Estimates of the cost of achieving fuel economy improvements were also sought.

C.1.2 Scope

The studies examined were all published between 1982 and 1990, with only one of the studies projecting fuel efficiencies beyond 2010.

Only fuel efficiencies of passenger automobiles were considered. The study does not attempt to analyze the effects of improvements in other modes such as light trucks. However, most of the programs described can be applied to light trucks, although generally not with identical

results (for example, there appears to be more opportunity to improve light truck fuel efficiency through weight reductions and manual transmissions use).

Improvements in fuel efficiency are applied to new vehicles only. Fleet effects will be discussed in the conclusions section.

The following categories represent the factors leading to fuel efficiency improvements that were considered.

"Technical Fix" actions

"Technical Fix" Actions represent the use of technology alone to improve the fuel efficiency of an individual vehicle.

The technical fix programs considered include:

- Vehicle Programs (engine switching, weight reduction, friction resistance, etc.);
- Drivetrain Improvements (continuously variable transmission, five-speed automatic transmissions, etc.);
- Engine Improvements (advanced carburation control, reduced internal friction, etc.);

Vehicle stock measures

Some studies (OTA, 1989; EMR, 1990) examined the effect of a gradual tendency to drive smaller vehicles. These studies considered possible improvements in the average fuel efficiency of new vehicles only—they did not attempt to analyze the fleet effects of improving fuel efficiency or purchasing decisions.

Other effects

One study (EMR, 1990) considered that the advent of improved technology has allowed performance increases without penalties in fuel efficiency. Similarly, larger vehicles are possible without efficiency penalties. While fuel consumption rates are declining (MENY, 1988), the recent market shift towards larger, more powerful cars has a negative effect on average new vehicle efficiency.

Please see Appendix A for a complete list of actions considered.

C.1.3 Methodology

Given the many studies, varying time periods and differing effects considered, a method was sought which provided an estimate of fuel efficiency potentials over the fifteen year time horizon of this study. Since each study produced at least one estimate of future fuel efficiency (at least calculable), it was possible to plot the data and to estimate a relationship between time and potential new vehicle fuel consumption rates.

A similar procedure was followed for estimating costs. Several of the review articles estimated capital cost requirements for achieving specific fuel economy improvements. These were converted to a cost per new vehicle where necessary. A plot showing fuel consumption reduction (in L per 100 km) versus cost per vehicle was produced, and a relationship calculated.

Scenarios

Each study described one or more scenarios limiting or affecting future fuel efficiencies. In general, the efficiency improvement perceived from a particular program is invariant among scenarios. Instead, the *penetration level* [1] of the program changes with time and scenario. The aggregate fuel efficiency improvement is the product of total, perceived efficiency gain and penetration. This point will be discussed further in the next section: for now consider that the various scenarios weighed the combined effects of penetration and fuel efficiency improvements.

Each scenario thus provides two data points for the linear regression described below. The point estimates consist of a time value (year) and a fuel consumption estimate (L/100 km) for the base year and for the forecast year. Additionally, some studies provided an estimate of cost per vehicle for a given reduction in fuel consumption.

Scenario descriptions were generally related to technical potential, economic attractiveness, market potential, or current product plans. Other studies specified assumptions such as "no shift to smaller cars" or provided high/low ranges.

No attempt was made in this study to separate scenarios on any of these terms. Instead, each scenario was considered as a discrete estimate, each with equal probability of occurrence.

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1 *Penetration* is used to estimate the influence of time and technology on fuel economy improvements. Although a given technology may be perceived to provide a certain percentage improvement in fuel economy, an author may feel that it will not be fully implemented.

Additivity and inclusion of programs

None of the studies reviewed explicitly considered all the possible programs listed in Appendix A. Consequently, it may be possible to design a comprehensive case which utilizes the estimates of fuel efficiency gains from all possible sources.

This was not done for two reasons:

(1) although the programs appear exhaustive, their description in each of the studies is sufficiently vague as to make a quantitative estimate of the particular efficiency/penetration level difficult;

(2) the combined effect of improvements in each category is not strictly additive (in fact, some are mutually exclusive); even when an exhaustive list of efficiencies and penetration levels for all programs was given, the authors always estimated the total efficiency gain as something less than the sum of all efficiency and penetration level products.

It was therefore judged that each scenario constituted the author's best estimate of future efficiency improvements (and costs), and that each author considered all program sectors to some degree in their estimates.

Table C-1 presents the primary data used to produce the linear regressions.

C.1.4 Fuel economy estimates

Units

Only two of the case studies examined were performed in terms of changing fuel consumption (Canadian "combined, 55 per cent urban and 45 per cent highway, fuel consumption" units of L per 100 km). These are shown shaded in Table 1. The others all expressed percentage improvements to, or absolute values of United States miles per US gallon.

Given the inverse relationship between fuel economy and fuel consumption, a percentage change in one parameter is not directly transferable to the other. United States figures were therefore translated to Canadian by the following process:

- where a percentage improvement was specified, the base fuel economy (in miles per US gallon) was adjusted by the percentage, and the result transformed to Canadian units using standard conversion factors;

- where an absolute, future fuel economy was specified, the result was directly transformed to Canadian units using standard conversion factors.

To alleviate confusion, Table 1 shows *total* percentage improvements relative to both L per 100 km and miles per US gallon. Usually, the latter is specified and the former calculated. Also, since the percentage improvements are calculated with respect to the particular study's base year, a column showing the percentage improvement relative to 1988 has been provided.

In all cases, the percentage improvements shown for each program is relative to the base economy in miles per US gallon. Neither Canadian study specified percentage improvements in the various program categories.

Fuel economy improvements

The perceived potential for fuel economy gains through a specific program were quite consistent across the studies. Differences between authors usually amounted to three or four percent. The largest differences occurred when different time points were being examined. For example, Cheng's economy improvement estimates for 2010 from Vehicle Programs are consistently one or two percent higher than other studies and scenarios for 2005.

Efficiency improvements are always relative to a particular scenario's *base* year efficiency. Since most of the studies reviewed used the year prior to publication as the base year, it is not surprising that differences occur in per cent reduction estimates.

Several cases where authors' estimates differ by substantial amounts (more than three or four percent) cannot be explained by a difference in forecast year. For example, Cheng's "High" scenarios for 1995 and 2010 are consistently higher than other estimates for similar dates. His "Low" scenarios are about equal to other studies (Cheng, 1988). Cheng's use of the "High" estimate identifies it as an optimistic one. However, the "Low" scenario is not (relatively) pessimistic either.

Penetration levels

Larger relative differences appear when considering the various penetration levels of each fuel economy increase. These varied widely among scenarios and authors. This does not necessarily constitute widely varying opinions or disagreement. Rather, the penetrations reflect the differing economic, physical, technical, or market limitations each scenario is attempting to describe (for example "Low" versus "High", "Current Trends" versus "Free Market"), and what the effects of different forecast years is.

Regression analysis

Each scenario contributed two data points to the analysis: one for the base year, and one for the forecast year (recall that each point estimate consists of a time value and a fuel consumption value). Base year values are generally historic data, and are quite close across the studies. However, including them in the regression helps account for any perceived differences in calculation methods employed by the authors.

Statistically, the inclusion of the base data points aides the regression analysis by tempering the data with a dose of reality. For example, OTA provided quite optimistic forecasts even for 1985 when they published their study in 1982 (their estimate for 1985 was almost 16% lower than what was actually achieved). If the base data points were not included then overly optimistic forecasts may be given undue weight.

A plot of the data points and the regression lines is shown in Figure C.1.1.

Two regression lines are shown in Figure C.1.1 as two tests were calculated. One including all data points and one which excludes very low or very high estimates. As points lying greatly outside the body of data can have a disturbing effect on linear regressions, these points were removed.

Without the point estimate for 2050, the linear regression predicts a somewhat more optimistic view of the future for automobile fuel consumption rates. This may or may not be realistic. As technological efficiency improvements may be slowing, it might not be realistic to assume that improvements will occur in linear increments over the next twenty years. However, it is equally difficult to assume that linear reductions in fuel consumption will occur over the next sixty years.

Final estimates of future fuel consumption ratings

The following table presents estimates of future fuel consumption ratings from various sources, including this study.

Figure C.1.1
Automobile Fuel Economy
Capability of Technology

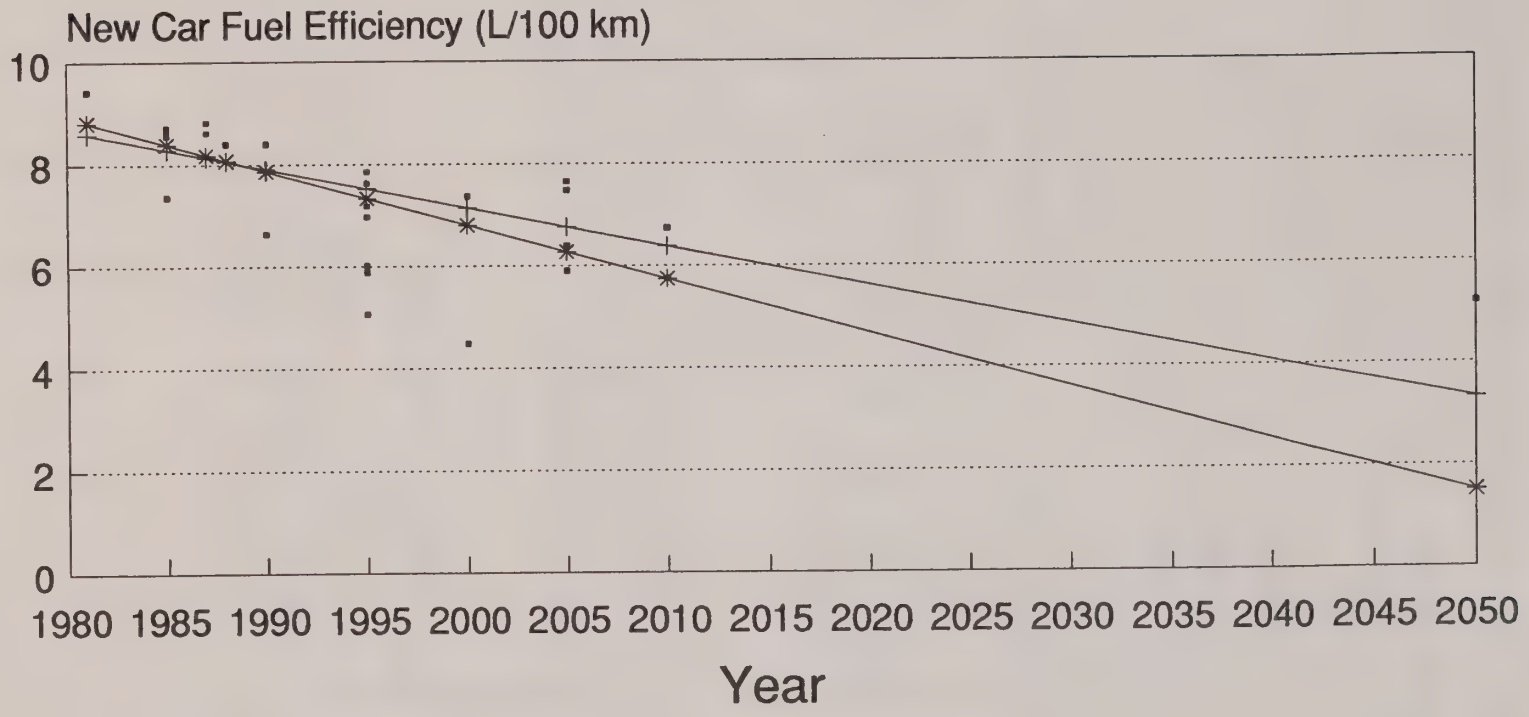


Table C-1
Comparison of Future Fuel Consumption Estimates (L/100 km)

Description of Estimate	Year of Estimate			
	1990	1995	2000	2005
Fleet average[1]	10.76	10.54	9.97	9.52
New vehicle average[1]	10.27	9.50	8.94	8.97
Average vehicle < 1,000 kg[2]	8.80	n.a.[5]	n.a.	n.a.
"Best car" on market[3]	5.00	n.a.	n.a.	n.a.
Prototype vehicles[4]	3.10	n.a.	n.a.	n.a.
Linear regression analysis	7.86	7.28	6.76	6.24

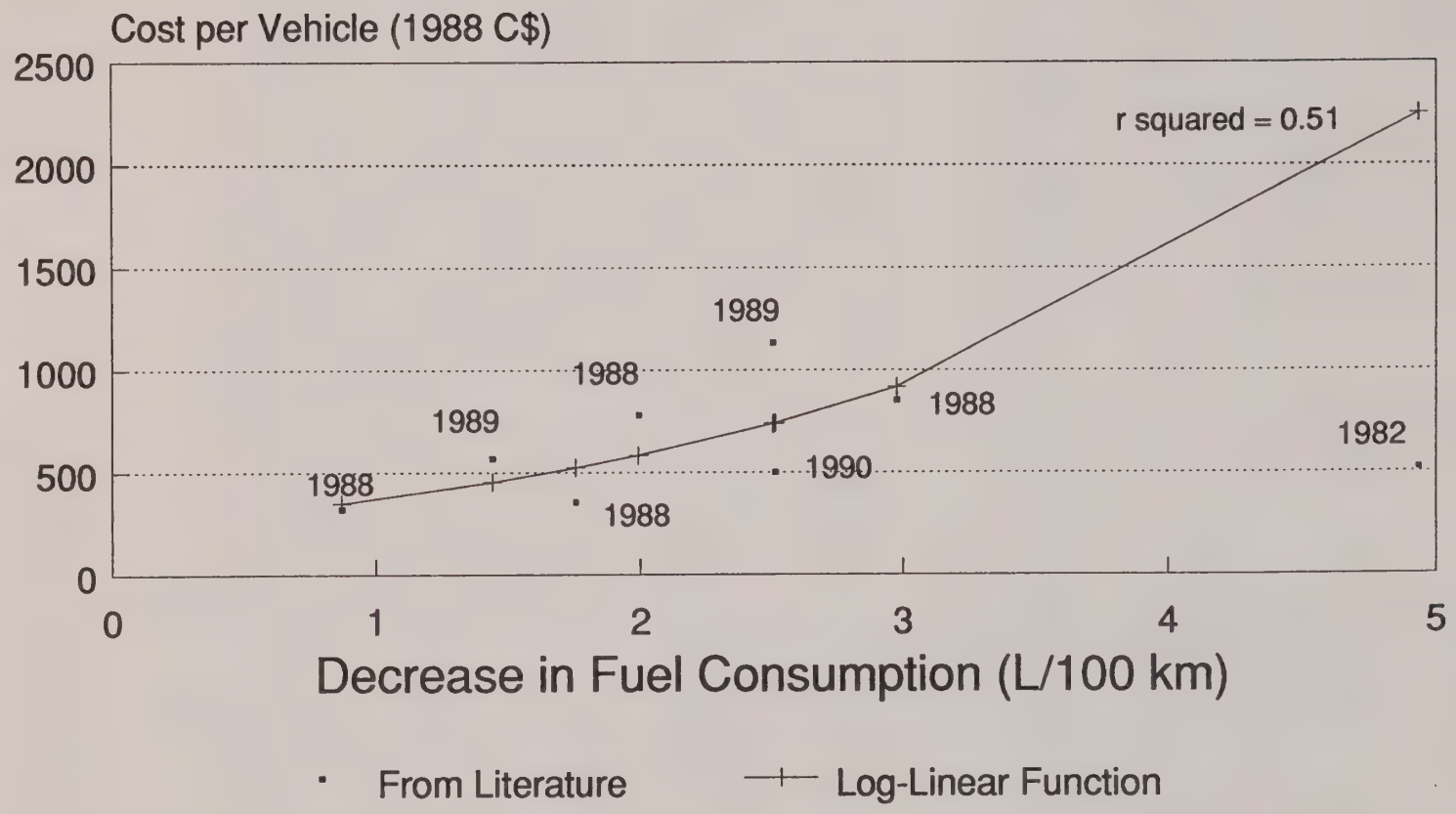
Notes & Sources
1 MENY Energy Demand Model, 1989
2 Statistics Canada, 1989. Figure is for January to December, 1988.
3 Pontiac Firefly 5-sp, 55/45 urban/highway (Transport Canada,1989)
4 Bleviss, 1988. Figure is an average of seven prototype vehicles.
5 not available.

Linear regression figures shown in Table C-1 have been rounded to represent 30, 35 and 40 per cent reductions in fuel consumption for the years 1995 through 2005. The actual values obtained from the regression are within one per cent of the values shown. The values for 1995, 2000 and 2005 were subsequently used as the "Low, Medium, and High" measures for 1995 CAFE standards.

C.1.5 Cost per vehicle estimates

Figure C.1.2 on the following page shows the results of analysis for cost estimates. A log-linear regression line through the data points has been calculated omitting the point marked "1982". This estimate was made in the early 1980s and is much lower than estimates made in the latter part of the decade. Data from this study were also omitted from the fuel consumption analysis.

Figure C.1.2
Cost of Fuel Consumption Decrease
Automobiles Only



Interpolation from Figure C.1.2 permits the calculation of a cost per vehicle of attaining a given reduction in fuel consumption. Using MENY's estimates of Ontario's future fleet size yields an estimate of the total cost to consumer of achieving specific fuel consumption reductions. These costs are shown in Table C-2.

C.1.6 Implementation

In the example above, it has been assumed that implementation of the indicated standard occurs in 1995, and persists through 2005. In practice, it is more likely to expect that fuel economy increases more gradually, and to a greater extent; for example, some studies have indicated that the fleet average fuel economy will be 5.97 L/100 km and could be as low as 5.12 L/100 km in an optimistic scenario (Energy and Environmental Analysis,1990).

It should be noted, however, that the timing of implementation can have a significant impact on the effectiveness of CAFE standards. This is illustrated in Figure C.1.3 which indicates how new vehicle CAFE must increase depending on implementation year to achieve an overall fleet average reduction of 20 per cent by 2005.

C.1.7 Conclusions

Three estimates of possible CAFE standards were derived from a literature review of future fuel economy reductions. The values correspond to low, medium and high enforcement and application of regulation. Costs of achieving each consumption reduction were also estimated.

The standards were assumed to be applied in 1995: the average of all subsequently manufactured vehicles (including 1995 vehicles) would achieve that fuel consumption rating. Costs were assumed to be borne by the consumer over a five year period.

The derived fuel consumption rates, resulting fleet average fuel consumption rates, and total costs to consumer are summarized in Table C-3.

Energy reduction estimates were calculated using fleet characteristics (number of vehicles, fuel consumption rates, and survival rates by vintage) provided by the MENY Energy Demand Model. The "New Vehicle" fuel consumption ratings were substituted for the baseline estimates (see Appendix E.1) for all new vehicles entering the system after 1994. The resulting fleet average fuel consumption reductions for a given year are equivalent to energy reductions for that year.

Given future fuel prices, the perceived benefit per vehicle can also be determined using MENY Energy Demand Model data. Assuming incremental costs are spread over five years, the following annual benefits might be expected for a typical vehicle owner.

Table C-2
Cost of fuel consumption reductions from technology.

Year	Proposed Fuel Efficiency (L/100 km)	Difference[1] (L/100 km)	Cost per Vehicle[2] (1988 C$)	Cumulative Vehicles Purchased[3]	Total Cost[4] (M 1988 C$)
Low Case:	30% reduction in 1988 fuel consumption introduced in 1995				
1995	7.28	3.12	$978	532,424	$124
2000			$978	3,264,186	$758
2005			$978	3,382,909	$785
Medium Case:	35% reduction in 1988 fuel consumption introduced in 1995				
1995	6.76	3.64	$1,241	532,424	$157
2000			$1,241	3,264,186	$962
2005			$1,241	3,382,909	$997
High Case:	40% reduction in 1988 fuel consumption introduced in 1995				
1995	6.24	4.16	$1,574	532,424	$199
2000			$1,574	3,264,186	$1220
2005			$1,574	3,382,909	$1264

Notes & Sources:

1 Difference calculated from baseline 1995 fuel consumption estimate of 10.39 L per 100 km.

2 Cost per vehicle determined from regression analysis.

3 Assuming costs are spread over the first five years of vehicle life, this column shows the number of vehicles with "unpaid for" fuel efficiency improvements. The numbers represent all 1995 vehicles for 1995, all 1996-2000 vehicles for 2000, and all 2001-2005 vehicles for 2005.

4 Costs in indicated year are the number of vehicles times the annual value of the incremental vehicle cost, assuming the incremental vehicle cost is spread over five years at a six percent discount rate.

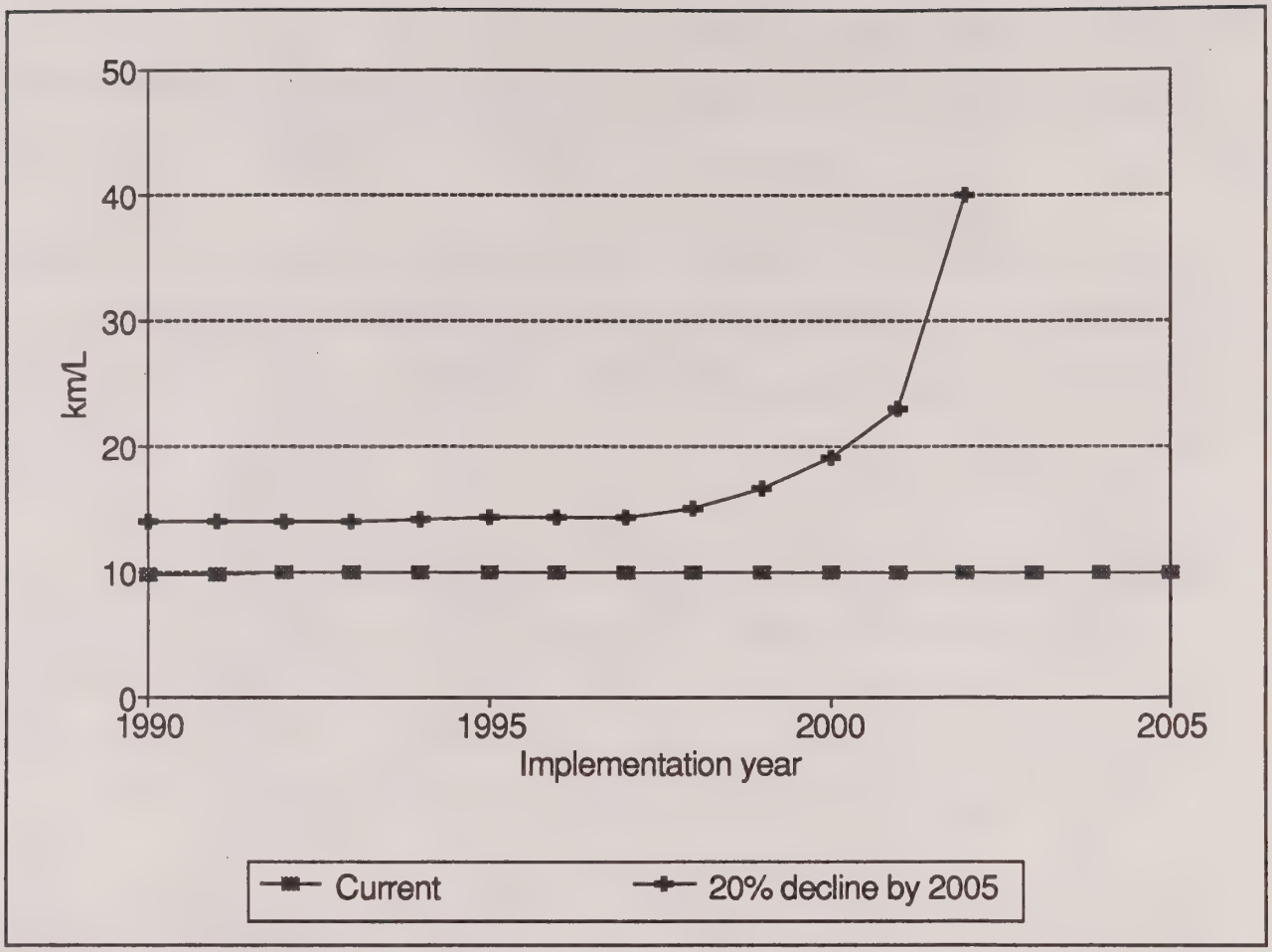


Figure C.1.3
Fuel efficiencies required to meet a fleet average objective of 20% reduction relative to 1988 levels.

Achieving these energy savings requires prompt implementation or announcement of CAFE standards. Incorporation of new technology into the automobile product line may take five years or more (OTA, 1982) and industry may object to stringent standards. If industry is to have some input into the setting of new CAFE standards, as well as enough time to implement them, then the process must begin shortly.

Even with prompt action, the 1995 CAFE levels used in the scenarios here will be difficult to achieve, and can probably only be achieved through product mix changes.

Table C-3
Derived fuel consumption rates.

Stringency of CAFE Standard Measure	Fuel Consumption (L/100 km)				Energy Reduction from Passenger Car (%)			Total Cost in 2005 (M 1988 C$)
	New Vehicle	Fleet Average						
	1995	1995	2000	2005	1995	2000	2005	
Low	7.28	10.20	8.40	7.59	3	16	20	$785
Medium	6.76	10.09	7.96	7.05	4	20	26	$997
High	6.24	9.97	7.50	6.51	5	25	32	$1264

Table C-4
Comparison of costs and benefits

CAFE Stringency	Fuel Consumption Estimate (L/100 km)	Cost per Vehicle ($)[1]	Annual cost ($/a)[2]	Average Fuel Price ($/L)[3]	Average Benefit per Vehicle ($/a)[4]	Net Benefit per Vehicle ($/a)
Low	7.28	978	$232	0.5581	313	81
Medium	6.76	1,241	$295	0.5581	365	71
High	6.24	1,574	$374	0.5581	418	44

Notes & Sources:
1 Incremental vehicle cost to reduce to indicated efficiency from 10.4 L/100 km. All costs and benefits in 1988 Canadian Dollars.
2 Annual incremental vehicle cost, assuming costs are spread over five years with a discount rate of 6%/a.
3 MENY, 1989. Price Model. Estimate for 2005.
4 Fuel savings relative to base efficiency, assuming 18 000 km/a.

Appendix C.2 Increase in the transit mode share

In 1988, the transit mode share of total urban passenger transportation in Ontario is estimated to be about 10 per cent of total person trips. If the public transit system in Ontario expanded or improved, both a reduction in the number of private motor vehicle trips and an increase in the number of persons per vehicle using travel corridors is possible (Wilbur Smith Associates, 1983). The increase in the transit share also provides:

- improved energy efficiency characteristics; and
- reduced pollution from the transportation sector.

What follows is an examination of the possibility and the effects of an increase in the transit share of urban passenger transportation in Ontario. The report is organized as follows: Section C.2.1 provides an overview of the type of actions and measures possible for increasing the public transit mode share in Ontario; Section C.2.2 reviews the effectiveness of such measures and actions in Ontario; Section C.2.3 provides estimates of the potential energy savings, and costs of three different increases in the transit mode share for the Province; and Section C.2.4 presents conclusions regarding an increased transit mode share in Ontario.

C.2.1 Overview of potential actions and measures

There are a number of actions which could be adopted through public transit improvement and expansion which result in more efficient use of energy and reduced pollution from the transportation sector (Table C-5).

In addition, there a number of actions which improve the marketing of transit:

- consumer and market research;
- service planning;
- transit promotion; and
- customer service.

The appeal of public transit to commuters can be enhanced through improved station lighting and design, advertising, better security and the use of communications equipment which permits the monitoring of traffic flows and informs commuters of bus and train arrivals and departures.

In Ontario most transit authorities have already adopted at least some of these actions. However, actions which would increase ridership and provide an impetus for expanded transit services have not been fully implemented across the province, or fully in any single transit service area.

The adoption of actions which increase public transit ridership does not ensure increased ridership. The decision by individuals to use public transit is made within an environment where there is a high level of private motor vehicle ownership and low density land-use practises. A number of factors such as:

- availability or convenience of transit services;
- availability or convenience of good roads and parking facilities;
- cost of public transit; and
- cost of motor vehicle ownership and operation

affect public transit ridership. These factors must be considered in any strategy developed to increase the transit mode share.

Table C-5
Actions and measures associated with increased transit mode share

Type of action	Action	Economic incentives & disincentives	Regulatory and related measures
Reduce Transit Travel Time	• service integration • express routes • exclusive bus lanes • transit vehicle priorities • timed transfers • fewer stops • fewer transfers • transit information	• Joint private-public development of transit stations. • Communications equipment which permits the monitoring of traffic flows. • Single fares between transit regions.	• Increase use of honour system for riders. • Restrict private vehicle access into downtown core during peak hours • Implement parking controls. • Require municipalities to provide specific levels of transit efficiency and convenience improvements, park and ride, express service, service expansion, reserved lanes or exclusive ROWs for transit vehicles, fare incentives, shelters, etc.
Expand Coverage by Transit	• new routes • increased frequency • extended hours • special services	• Sale of transit bonds for capital improvements. • Joint private-public development of transit stations. • Special taxes on businesses which benefit from their proximity to transit stations. • Provide tax credits for integrating development with public transit. • Incentives for businesses to locate near transit stations.	• Require municipalities to provide specific levels of transit services. • Simplify regulatory approval of transit developments through exemptions or streamlining of approvals process. • Require transit integration into new developments. • Require all government offices to be in easy access to transit. • Require expansion of transit to airports. • Require under-utilized freight rail right-of-ways to be used for transit.

Table C-5
Actions and measures associated with increased transit mode share

Type of action	Action	Economic incentives & disincentives	Regulatory and related measures
Route and Schedule Improvements	• improved route structures and spacing • better schedules • reduced non-revenue kilometres	• Time of day pricing.	• Increase the frequency of buses and trains. • Restrict private vehicle access into downtown core during peak hours • Implement parking controls. • Require municipalities to provide specific levels of transit efficiency and convenience improvements, park and ride, express service, service expansion, reserved lanes or exclusive ROWs for transit vehicles, fare incentives, shelters, etc. • Require transit integration into new developments. • simplify regulatory approval of transit developments through exemptions or streamlining of approvals process. • Communications equipment which permits the monitoring of traffic flows.
Competitive Pricing of Fares	• monthly pass • employer programs • merchant discounts • fare integration • volume discount • honour system	• Provide tax exemptions for employer provided economic incentives to employees for taking transit, e.g. transit passes as a non-taxable employee benefit. • tax credits for employers which encourage employees to use transit. • Regional and inter-city transit passes. • Yearly transit passes. • Require drivers travelling into the urban core to buy transit passes.	• Require businesses in the downtown core to encourage employees to take transit.

Sources: W. Smith, 1983; CUTA, 1990; OECD, 1988.

C.2.2 Potential for an increased transit mode share in Ontario

Introduction

The MENY Energy Demand Model estimates energy use on a provincial basis. However, to determine the effectiveness and the potential for expanded public transit services regional demand for different transportation modes, and total energy demand must be considered. A disaggregated procedure was developed to estimate regional demand for public transit.

Base year estimates

The analysis of disaggregated regional demand for public transit is based on the 51 Regional Municipalities and Counties making up the Province of Ontario. Population and employment estimates for each of the Regional Municipalities and Counties shown on Table C-6 are based on:

- Municipal Directories, providing 1985 and 1988 population estimates from which the 1986 population was interpolated; and

- the 1986 Census Place of Work data file providing 1986 employment levels.

Because of limited data availability 1986, 1991, 1996, 2001, and 2006 forecasts are used for the regional analysis and assumed to be equivalent to the 1988, 1990, 1995, 2000 and 2005 base years used in the study.

Travel demands could be established: for The Regional Municipalities and Counties with significant urban areas. In addition, one rural area (Grey County) was selected to represent other rural areas. The areas considered are:

- Essex
- Lambton
- Middlesex
- Waterloo/Brant
- Niagara
- Greater Toronto Area
- Frontenac
- Ottawa-Carleton
- Sudbury Region
- Algoma
- Thunder Bay
- Grey

These areas are shown on Exhibit 1.

TABLE C-6
POPULATION AND EMPLOYMENT ESTIMATES BY 1986 CENSUS DIVISION

PLACE-OF-WORK LINKAGES AMONG MUNICIPALITIES OF ONTARIO

	CENSUS DIVISION	POPULATION 1985	POPULATION 1986*	EMPLOYMENT 1986**	POPULATION 1988
STOR.-DUNDAS-GLENGARRY	1	101 510	103 000	36993	101 978
PRESCOTT - RUSSELL	2	56 553	57 600	13784	59 138
OTTAWA - CARLTON	6	599 688	606 600	340926	623 135
LEEDS - GRENVILLE	7	83 176	84 600	31538	83 166
LANARK	9	48 400	49 600	19253	49 483
FRONTENAC COUNTY	10	117 878	115 200	58304	119 332
LENNOX - ADDINGTON	11	33 094	34 400	9350	32 998
HASTINGS COUNTY	12	107 863	109 400	49271	106 240
PRINCE EDWARD COUNTY	13	22 228	22 400	6577	21 793
NORTHUMBERLAND	14	66 568	67 700	25489	67 232
PETERBOROUGH COUNTY	15	102 740	105 100	42549	105 493
VICTORIA COUNTY	16	51 528	52 600	17211	55 132
DURHAM REGION	18	314 238	326 200	129159	347 837
YORK REGION	19	324 064	350 600	158873	409 292
METRO	20	2 154 537	2 192 700	1301399	2 133 559
PEEL REGION	21	565 871	592 200	292925	608 327
DUFFERIN COUNTY	22	32 370	32 600	11987	34 452
WELLINGTON COUNTY	23	139 758	139 400	63567	143 778
HALTON REGION	24	264 498	271 400	113339	281 668
HAMILTON - WENTWORTH	25	421 264	423 400	191751	429 466
NIAGARA	26	369 312	370 100	150215	365 197
HALDIMAN - NORFOLK	28	88 400	90 100	37170	89 225
BRANT COUNTY	29	101 212	106 300	42863	102 085
WATERLOO REGION	30	328 224	329 400	163360	342 030
PERTH	31	66 333	66 600	31532	66 226
OXFORD	32	84 757	85 400	35212	84 008
ELGIN	34	69 284	70 300	29960	69 174
KENT	36	105 476	106 700	49338	105 176
ESSEX	37	315 743	316 400	134826	314 952
LAMBTON	38	122 091	125 400	51564	119 528
MIDDLESEX	39	338 278	333 400	160141	344 586
HURON COUNTY	40	55 553	56 000	19887	55 589
BRUCE COUNTY	41	58 092	59 400	21672	57 119
GREY COUNTY	42	74 279	74 800	26313	75 157
SIMCOE COUNTY	43	231 711	238 400	92866	241 694
MUSKOKA	44	37 941	40 300	16873	39 958
HALIBURTON	46	11 541	12 000	3648	11 945
RENFREW	47	86 991	89 000	36005	85 953
NIPISSING	48	73 733	79 100	31932	74 599
PARRY SOUND	49	29 498	33 800	10250	30 138
MANITOULIN	51	6 779	10 300	3009	6 771
SUDBURY DISTRICT	52	18 208	25 800	7660	17 363
SUDBURY REGION	53	154 387	152 500	61799	151 314
TIMISKAMING	54	37 312	40 300	14787	35 741
COCHRANE	56	86 609	95 000	37429	84 846
ALGOMA	57	123 853	132 200	53936	117 339
THUNDER BAY	58	143 908	155 700	68582	140 951
RAINY RIVER	59	19 645	23 000	9698	18 981
KENORA	60	36 322	59 100	22676	35 150
TOTALS		8 883 298	9 113 500	4 339 448	9 096 294

* - Ministry of Treasury and Economics, "Population Projections for Regional Municipalities, Counties and Districts of Ontario to Year 2011", July, 1988.

** - From place of work linkages.

THE PROVINCE OF ONTARIO

(COUNTIES, DISTRICTS, REGIONAL & DISTRICT MUNICIPALITIES)

EXHIBIT 1

Base year energy use estimates

The 1986 Census Place of Work trip linkage file is used as the base for establishing the numbers of daily trips for each of the study areas and the Province (Table C-7). The number of daily trips made in 1986 is estimated by doubling the total number of home to work trips to obtain the total number of work trips, approximately 33% of total trips. Average trip lengths for each region are established using a weighted average of urban and rural trip lengths as scaled from a provincial map. The average trip length multiplied by the total daily trips provides an estimate of daily person trip kilometres.

Transit mode shares are estimated for each region. The transit mode share estimates, along with average daily vehicle occupancy factors used in the Energy Model are used to estimate the daily vehicle trip kilometres travelled.

A summary of the daily trips made estimates are shown in Table C-7. Where possible, information from the 1986 "Transportation Tomorrow Study" is used to reflect the Greater Toronto Area (GTA) attributes.

Future population and employment forecasts

Population estimates for the years 1991, 1996, 2001 and 2006 by Regional Municipality and County, are shown in Table C-7, Table C-8.

Estimates of employment were developed by applying the existing employment/population activity rate to the population forecasts. A summary of the population and employment forecasts, by year, are presented in Table C-9. Based on the forecast population and employment, the estimated daily work trips and transit mode share for the years 1991, 1996, 2001 and 2006 were developed. The estimated daily work trips and transit mode share are presented in Table C-10, Table C-11, Table C-12 and Table C-13.

TABLE C-7
ESTIMATED DAILY DEMAND FOR AUTOMOBILES AND LIGHT TRUCKS BY REGION IN ONTARIO FOR 1986 (DAILY PASSENGER VEHICLES)

AREA	POPULATION 1986	EMPLOYMENT 1986	1986 HOME TO WORK TRIPS	TOTAL WORK TRIPS 000's	TOTAL PERSON TRIPS * 000's	AVERAGE TRIP LENGTH (km)	PERSON TRIP KILOMETRES 000's	T.M.S. %	VEHICLE TRIP KILOMETRES** 000's
GREY	74 800	26 313	34588	69	210	25.4	5 324	2	3 077
ESSEX	316 400	134 826	146 064	292	885	19.0	16 840	5	9 433
LAMBTON	125 400	51 564	58 061	116	352	26.7	9 397	3	5 375
MIDDLESEX	333 400	160 141	169 563	339	1 028	19.2	19 693	5	11 031
WATERLOO/BRANT	435 700	206 043	219 647	439	1 331	12.2	16 197	5	9 072
NIAGARA	370 100	150 215	165 808	332	1 005	14.0	14 082	3	8 054
G.T.A.	4 156 500	2 187 446	2 227 873	4 456	12 043	10.2	122 834	18	59 389
FRONTENAC	115 200	58 304	56 087	112	340	18.7	6 364	3	3 640
OTTAWA-CARLETON	606 600	340 926	323 359	647	1 960	20.8	40 698	10	21 597
SUDBURY REGION	152 500	61 799	63 824	128	387	30.0	11 596	3	6 632
ALGOMA	132 200	53 936	56 010	112	339	49.1	16 662	3	9 529
THUNDERBAY	155 700	68 582	72 448	145	439	63.6	27 904	5	15 630
SUB-TOTAL	6 974 500	3 500 095	3 593 332	7 187	20 318	15.14	307 591	10.4	162 459
OTHER* **	2 139 000	839 353	704 181	1 408	5 727	25.4	145 478	2.00	84 061
TOTAL	9 113 500	4 339 448	4 297 513	8 595	26 046	17.40	453 069	7.72	246 520

NOTE:-FOR THE GTA HOME TO WORK TRIPS REPRESENT APPROX. 37% OF THE TOTAL PERSON TRIPS ---- T.T.S. 1986.

* HOME TO WORK TRIPS REPRESENT 33% OF THE TOTAL PERSON TRIPS ---- TRB 599.

** LOAD FACTORS: INTERCITY - 1.912 ---- MENY, 1990.
URBAN - 1.536
TOTAL - 1.696

*** ALL OTHER RURAL AREAS ARE ASSUMED TO HAVE A T.M.S. OF 2 PER CENT.

NOTE: -AVG. TRIP LENGTH IS A WEIGHTED AVG. OF URBAN & RURAL TRIP LENGTHS.
-GTA's AVG. TRIP LENGTH TAKEN FROM T.T.S. 1986.

TABLE C-8
POPULATION FORECASTS BY 1986 CENSUS DIVISION

	CENSUS DIVISION	POPULATION				
		1986	1991	1996	2001	2006
STOR.-DUNDAS-GLENGARRY	1	103 000	106 700	109 700	113 100	116 600
PRESCOTT - RUSSELL	2	57 600	65 600	72 800	79 400	85 700
OTTAWA - CARLTON	6	606 600	673 700	712 900	737 700	757 300
LEEDS - GRENVILLE	7	84 600	91 100	97 200	102 700	108 000
LANARK	9	49 600	54 300	58 700	62 900	67 000
FRONTENAC COUNTY	10	115 200	123 700	129 400	133 300	137 100
LENNOX - ADDINGTON	11	34 400	37 900	41 300	44 400	47 200
HASTINGS COUNTY	12	109 400	116 800	121 900	126 600	131 400
PRINCE EDWARD COUNTY	13	22 400	22 700	23 200	23 800	24 600
NORTHUMBERLAND	14	67 700	72 000	76 500	81 200	85 800
PETERBOROUGH COUNTY	15	105 100	109 200	113 900	118 700	123 400
VICTORIA COUNTY	16	52 600	58 800	65 100	71 000	76 700
DURHAM REGION	18	326 200	406 100	464 800	516 100	563 400
YORK REGION	19	350 600	472 800	573 500	658 100	734 100
METRO	20	2 192 700	2 320 700	2 395 500	2 444 900	2 476 900
PEEL REGION	21	592 200	708 900	803 300	883 200	953 400
DUFFERIN COUNTY	22	32 600	35 800	38 800	41 700	44 400
WELLINGTON COUNTY	23	139 400	152 100	163 500	173 100	182 200
HALTON REGION	24	271 400	297 600	324 900	350 100	374 800
HAMILTON - WENTWORTH	25	423 400	439 500	459 600	476 600	492 000
NIAGARA	26	370 100	381 700	392 000	400 600	408 000
HALDIMAN - NORFOLK	28	90 100	92 800	95 900	99 200	102 900
BRANT COUNTY	29	106 300	110 500	114 400	118 600	122 900
WATERLOO REGION	30	329 400	364 700	398 800	427 700	454 400
PERTH	31	66 600	67 600	68 800	70 300	72 100
OXFORD	32	85 400	85 300	86 200	87 100	88 500
ELGIN	34	70 300	72 400	74 800	77 300	79 900
KENT	36	106 700	111 500	115 600	119 400	123 300
ESSEX	37	316 400	335 200	352 300	369 000	384 200
LAMBTON	38	125 400	127 000	127 800	128 100	128 900
MIDDLESEX	39	333 400	358 900	379 600	396 700	412 400
HURON COUNTY	40	56 000	56 800	57 800	59 000	60 700
BRUCE COUNTY	41	59 400	59 200	58 300	58 400	59 300
GREY COUNTY	42	74 800	77 000	80 000	83 400	87 100
SIMCOE COUNTY	43	238 400	258 800	277 300	293 600	309 600
MUSKOKA	44	40 300	44 700	49 300	53 600	57 700
HALIBURTON	46	12 000	12 300	12 800	13 200	13 700
RENFREW	47	89 000	90 800	91 200	91 300	91 900
NIPISSING	48	79 100	79 600	79 600	79 700	80 200
PARRY SOUND	49	33 800	35 600	37 500	39 500	41 500
MANITOULIN	51	10 300	10 300	10 600	10 900	11 200
SUDBURY DISTRICT	52	25 800	24 600	23 900	23 600	23 500
SUDBURY REGION	53	152 500	150 200	148 900	146 600	144 300
TIMISKAMING	54	40 300	39 700	39 400	39 500	39 900
COCHRANE	56	95 000	92 900	90 400	87 800	85 700
ALGOMA	57	132 200	134 200	133 500	131 500	129 800
THUNDER BAY	58	155 700	160 800	164 100	166 500	168 600
RAINY RIVER	59	23 000	23 500	24 300	24 900	25 600
KENORA	60	59 100	62 400	64 500	66 000	67 700
TOTALS		**9 113 500**	**9 887 000**	**10 496 100**	**11 001 600**	**11 457 500**

Source: Ministry of Treasury and Economics, "Population Projections for Regional Municipalities, Counties and Districts of Ontario to Year 2011", July, 1988.

TABLE C-9

EMPLOYMENT FORECASTS BY 1986 CENSUS DIVISION

	CENSUS DIVISION	POPULATION 1986	EMPLOYMENT 1986	ACTIVITY RATE	POPULATION 1991	EMPLOYMENT 1991	POPULATION 1996	EMPLOYMENT 1996	POPULATION 2001	EMPLOYMENT 2001	POPULATION 2006	EMPLOYMENT 2006
STOR.-DUNDAS-GLENGARRY	1	103 000	36993	0.359	106 700	38 322	109 700	39 399	113 100	40 620	116 600	41 878
PRESCOTT - RUSSELL	2	57 600	13784	0.239	65 600	15 698	72 800	17 421	79 400	19 001	85 700	20 508
OTTAWA - CARLTON	6	606 600	340926	0.562	673 700	378 638	712 900	400 670	737 700	414 608	757 300	425 624
LEEDS - GRENVILLE	7	84 600	31538	0.373	91 100	33 961	97 200	36 235	102 700	38 285	108 000	40 261
LANARK	9	49 600	19253	0.388	54 300	21 077	58 700	22 785	62 900	24 416	67 000	26 007
FRONTENAC COUNTY	10	115 200	58304	0.506	123 700	62 606	129 400	65 491	133 300	67 465	137 100	69 388
LENNOX - ADDINGTON	11	34 400	9350	0.272	37 900	10 301	41 300	11 225	44 400	12 068	47 200	12 829
HASTINGS COUNTY	12	109 400	49271	0.450	116 800	52 604	121 900	54 901	126 600	57 017	131 400	59 179
PRINCE EDWARD COUNTY	13	22 400	6577	0.294	22 700	6 665	23 200	6 812	23 800	6 988	24 600	7 223
NORTHUMBERLAND	14	67 700	25489	0.376	72 000	27 108	76 500	28 802	81 200	30 572	85 800	32 304
PETERBOROUGH COUNTY	15	105 100	42549	0.405	109 200	44 209	113 900	46 112	118 700	48 055	123 400	49 958
VICTORIA COUNTY	16	52 600	17211	0.327	58 800	19 240	65 100	21 301	71 000	23 232	76 700	25 097
DURHAM REGION	18	326 200	129159	0.396	406 100	160 795	464 800	184 038	516 100	204 350	563 400	223 078
YORK REGION	19	350 600	158873	0.453	472 800	214 247	573 500	259 879	658 100	298 215	734 100	332 655
METRO	20	2 192 700	1301399	0.594	2 320 700	1 377 369	2 395 500	1 421 764	2 444 900	1 451 083	2 476 900	1 470 076
PEEL REGION	21	592 200	292925	0.495	708 900	350 649	803 300	397 343	883 200	436 865	953 400	471 588
DUFFERIN COUNTY	22	32 600	11987	0.368	35 800	13 164	38 800	14 267	41 700	15 333	44 400	16 326
WELLINGTON COUNTY	23	139 400	63567	0.456	152 100	69 358	163 500	74 557	173 100	78 934	182 200	83 084
HALTON REGION	24	271 400	113339	0.418	297 600	124 280	324 900	135 681	350 100	146 205	374 800	156 520
HAMILTON - WENTWORTH	25	423 400	191751	0.453	439 500	199 042	459 600	208 145	476 600	215 844	492 000	222 819
NIAGARA	26	370 100	150215	0.406	381 700	154 923	392 000	159 104	400 600	162 594	408 000	165 598
HALDIMAN - NORFOLK	28	90 100	37170	0.413	92 800	38 284	95 900	39 563	99 200	40 924	102 900	42 451
BRANT COUNTY	29	106 300	42863	0.403	110 500	44 557	114 400	46 129	118 600	47 823	122 900	49 557
WATERLOO REGION	30	329 400	163360	0.496	364 700	180 866	398 800	197 778	427 700	212 110	454 400	225 351
[illegible]	31	66 600	31532	0.473	67 600	32 005	68 800	32 574	70 300	33 284	72 100	34 136
OXFORD	32	85 400	35212	0.412	85 300	35 171	86 200	35 542	87 100	35 913	88 500	36 490
ELGIN	34	70 300	29960	0.426	72 400	30 855	74 800	31 878	77 300	32 943	79 900	34 051
KENT	36	106 700	49338	0.462	111 500	51 558	115 600	53 453	119 400	55 210	123 300	57 014
ESSEX	37	316 400	134826	0.426	335 200	142 837	352 300	150 124	369 000	157 240	384 200	163 717
LAMBTON	38	125 400	51564	0.411	127 000	52 222	127 800	52 551	128 100	52 674	128 900	53 003
MIDDLESEX	39	333 400	160141	0.480	358 900	172 389	379 600	182 332	396 700	190 546	412 400	198 087
HURON COUNTY	40	56 000	19887	0.355	56 800	20 171	57 800	20 526	59 000	20 952	60 700	21 556
BRUCE COUNTY	41	59 400	21672	0.365	59 200	21 599	58 300	21 271	58 400	21 307	59 300	21 636
GREY COUNTY	42	74 800	26313	0.352	77 000	27 087	80 000	28 142	83 400	29 338	87 100	30 640
SIMCOE COUNTY	43	238 400	92866	0.390	258 800	100 813	277 300	108 019	293 600	114 369	309 600	120 601
MUSKOKA	44	40 300	16873	0.419	44 700	18 715	49 300	20 641	53 600	22 442	57 700	24 158
HALIBURTON	46	12 000	3648	0.304	12 300	3 739	12 800	3 891	13 200	4 013	13 700	4 165
RENFREW	47	89 000	36005	0.405	90 800	36 733	91 200	36 895	91 300	36 935	91 900	37 178
NIPISSING	48	79 100	31932	0.404	79 600	32 134	79 600	32 134	79 700	32 174	80 200	32 376
PARRY SOUND	49	33 800	10250	0.303	35 600	10 796	37 500	11 372	39 500	11 979	41 500	12 585
MANITOULIN	51	10 300	3009	0.292	10 300	3 009	10 600	3 097	10 900	3 184	11 200	3 272
SUDBURY DISTRICT	52	25 800	7660	0.297	24 600	7 304	23 900	7 096	23 600	7 007	23 500	6 977
SUDBURY REGION	53	152 500	61799	0.405	150 200	60 867	148 900	60 340	146 600	59 408	144 300	58 476
TIMISKAMING	54	40 300	14787	0.367	39 700	14 567	39 400	14 457	39 500	14 493	39 900	14 640
COCHRANE	56	95 000	37429	0.394	92 900	36 602	90 400	35 617	87 800	34 592	85 700	33 765
ALGOMA	57	132 200	53936	0.408	134 200	54 752	133 500	54 466	131 500	53 650	129 800	52 957
THUNDER BAY	58	155 700	68582	0.440	160 800	70 828	164 100	72 282	166 500	73 339	168 600	74 264
RAINY RIVER	59	23 000	9698	0.422	23 500	9 909	24 300	10 246	24 900	10 499	25 600	10 794
KENORA	60	59 100	22676	0.384	62 400	23 942	64 500	24 748	66 000	25 323	67 700	25 976
TOTALS		9 113 500	4 339 448	0.476	9 887 000	4 707 755	10 496 100	4 997 781	11 001 600	5 238 478	11 457 500	5 455 558

TABLE C-10
ESTIMATED BASE CASE DAILY WORK TRIP AND TRANSIT MODE SPLIT BY REGION IN ONTARIO FOR 1991 (DAILY - PASSENGER VEHICLES)

AREA	POP'N. 1991	EMPLOY. 1991	1991 HOME TO WORK TRIPS	TOTAL WORK TRIPS 000's	TOTAL PERSON TRIPS * 000's	AVERAGE TRIP LENGTH (km)	PERSON TRIP KILOMETRES 000's	T.M.S. %	VEHICLE TRIP KILOMETRES** 000's
GREY	77 000	27 087	35 605	71	216	25.4	5 481	2	3 253
ESSEX	335 200	142 837	154 743	309	938	19.0	17 841	5	10 266
LAMBTON	127 000	52 222	58 802	118	356	26.7	9 517	3	5 592
MIDDLESEX	358 900	172 389	182 532	365	1 106	19.2	21 200	5	12 198
WATERLOO/BRANT	475 200	225 423	239 560	479	1 452	12.2	17 665	5	10 165
NIAGARA	381 700	154 923	171 005	342	1 036	14.0	14 523	3	8 533
G.T.A.	4 645 600	2 426 382	2 489 339	4 979	13 456	10.2	137 250	18	68 168
FRONTENAC	123 700	62 606	60 225	120	365	18.7	6 833	3	4 015
OTTAWA-CARLETON	673 700	378 638	359 128	718	2 177	20.8	45 200	10	24 640
SUDBURY REGION	150 200	60 867	62 861	126	381	30.0	11 421	3	6 710
ALGOMA	134 200	54 752	56 857	114	345	49.1	16 914	3	9 937
THUNDERBAY	160 800	70 828	74 821	150	453	63.6	28 818	5	16 582
SUB-TOTAL	7 643 200	3 828 954	3 945 479	7 891	22 281	14.93	332 663	10.6	180 058
OTHER***	2243800	878801	716 781	1 434	5 975	25.4	151 769	2.00	90 087
TOTAL	9 887 000	4 707 755	4 662 260	9 325	28 256	17.14	484 432	7.93	270 145

* HOME TO WORK TRIPS REPRESENT 33% OF THE TOTAL TRIPS ---- TRB 599.

** VEHICLE OCCUPANCY: INTERCITY - 1.872 ---- MENY, 1990.
URBAN - 1.487
TOTAL - 1.651

*** ALL OTHER RURAL AREAS ARE ASSUMED TO HAVE A T.M.S. OF 2 PER CENT.

NOTE:-AVG. TRIP LENGTH IS A WEIGHTED AVG. OF URBAN & RURAL TRIP LENGTHS.
-GTA's AVG. TRIP LENGTH TAKEN FROM T.T.S. 1986.

TABLE C-11
ESTIMATED BASE CASE DAILY WORK TRIP AND TRANSIT MODE SPLIT BY REGION IN ONTARIO FOR 1996
(DAILY - PASSENGER VEHICLES)

	POP'N. 1996	EMPLOY. 1996	1996 HOME TO WORK TRIPS	TOTAL WORK TRIPS 000's	TOTAL PERSON TRIPS * 000's	AVERAGE TRIP LENGTH (km)	PERSON TRIP KILOMETRES 000's	T.M.S. %	VEHICLE TRIP KILOMETRES** 000's
GREY	80 000	28 142	36 993	74	224	25.4	5 695	2	3 473
ESSEX	352 300	150 124	162 637	325	986	19.0	18 751	5	11 085
LAMBTON	127 800	52 551	59 172	118	359	26.7	9 577	3	5 781
MIDDLESEX	379 600	182 332	193 060	386	1 170	19.2	22 422	5	13 255
WATERLOO/BRANT	513 200	243 907	258 717	517	1 568	12.2	19 078	5	11 278
NIAGARA	392 000	159 104	175 619	351	1 064	14.0	14 915	3	9 003
G.T.A.	5 021 600	2 606 850	2 690 839	5 382	14 545	10.2	148 360	18	75 703
FRONTENAC	129 400	65 491	63 001	126	382	18.7	7 148	3	4 315
OTTAWA-CARLETON	712 900	400 670	380 024	760	2 303	20.8	47 830	10	26 787
SUDBURY REGION	148 900	60 340	62 317	125	378	30.0	11 322	3	6 834
ALGOMA	133 500	54 466	56 561	113	343	49.1	16 826	3	10 156
THUNDERBAY	164 100	72 282	76 357	153	463	63.6	29 409	5	17 386
SUB-TOTAL	8 155 300	4 076 259	4 215 296	8 431	23 784	14.77	351 333	10.78	195 056
OTHER***	2 340 800	921 522	734 188	1 468	6 213	25.4	157 802	2.00	96 233
TOTAL	10 496 100	4 997 781	4 949 484	9 899	29 997	16.97	509 135	8.06	291 288

* HOME TO WORK TRIPS REPRESENT 33% OF THE TOTAL TRIPS ---- TRB 599.

** VEHICLE OCCUPANCY: INTERCITY - 1.832 ---- MENY, 1990.
URBAN - 1.439
TOTAL - 1.607

*** ALL OTHER RURAL AREAS ARE ASSUMED TO HAVE A T.M.S. OF 2 PER CENT.

NOTE:-AVG. TRIP LENGTH IS A WEIGHTED AVG. OF URBAN & RURAL TRIP LENGTHS.
-GTA's AVG. TRIP LENGTH TAKEN FROM T.T.S. 1986.

TABLE C-12
ESTIMATED BASE CASE DAILY WORK TRIP AND TRANSIT MODE SPLIT BY REGION IN ONTARIO FOR 2001
(DAILY - PASSENGER VEHICLES)

	POP'N. 2001	EMPLOY. 2001	2001 HOME TO WORK TRIPS	TOTAL WORK TRIPS 000's	TOTAL PERSON TRIPS * 000's	AVERAGE TRIP LENGTH (km)	PERSON TRIP KILOMETRES 000's	T.M.S. %	VEHICLE TRIP KILOMETRES** 000's
GREY	83 400	29 338	38 565	77	234	25.4	5 937	2	3 703
ESSEX	369 000	157 240	170 346	341	1 032	19.0	19 640	5	11 877
LAMBTON	128 100	52 674	59 311	119	359	26.7	9 600	3	5 927
MIDDLESEX	396 700	190 546	201 757	404	1 223	19.2	23 432	5	14 170
WATERLOO/BRANT	546 300	259 933	275 403	551	1 669	12.2	20 308	5	12 281
NIAGARA	400 600	162 594	179 472	359	1 088	14.0	15 242	3	9 411
G.T.A.	5 329 000	2 752 562	2 855 579	5 711	15 436	10.2	157 443	18	82 179
FRONTENAC	133 300	67 465	64 899	130	393	18.7	7 364	3	4 547
OTTAWA-CARLETON	737 700	414 608	393 244	786	2 383	20.8	49 494	10	28 354
SUDBURY REGION	146 600	59 408	61 355	123	372	30.0	11 147	3	6 883
ALGOMA	131 500	53 650	55 713	111	338	49.1	16 574	3	10 233
THUNDERBAY	166 500	73 339	77 473	155	470	63.6	29 839	5	18 044
SUB-TOTAL	8 568 700	4 273 357	4 433 118	8 866	24 996	14.64	366 020	10.89	207 608
OTHER***	2 432 900	965 121	754 737	1 509	6 445	25.4	163 707	2.00	102 121
TOTAL	11 001 600	5 238 478	5 187 855	10 376	31 442	16.85	529 726	8.14	309 730

* HOME TO WORK TRIPS REPRESENT 33% OF THE TOTAL TRIPS ---- TRB 599.

** VEHICLE OCCUPANCY: INTERCITY - 1.800 ---- MENY, 1990.
URBAN - 1.400
TOTAL - 1.571

*** ALL OTHER RURAL AREAS ARE ASSUMED TO HAVE A T.M.S. OF 2 PER CENT.

NOTE:-AVG. TRIP LENGTH IS A WEIGHTED AVG. OF URBAN & RURAL TRIP LENGTHS.
-GTA's AVG. TRIP LENGTH TAKEN FROM T.T.S. 1986.

TABLE C-13
ENERGY USE FORECASTS IN REGIONS OF ONTARIO FOR 2006 (DAILY - PASSENGER VEHICLES) BASE CASE

AREA	POP'N. 2006	EMPLOY. 2006	2006 HOME TO WORK TRIPS	TOTAL WORK TRIPS 000's	TOTAL PERSON TRIPS * 000's	AVERAGE TRIP LGTH. (km)	PERSON TRIP KILOMETRES 000's	T.M.S. %	VEHICLE TRIP KILOMETRES** 000's
GREY	87 100	30 640	40 240	80	244	25.4	6 195	2	3 862
ESSEX	384 200	163 717	177 500	355	1 076	19.0	20 465	5	12 367
LAMBTON	128 900	53 003	59 681	119	362	26.7	9 659	3	5 960
MIDDLESEX	412 400	198 087	209 912	420	1 272	19.2	24 380	5	14 733
WATERLOO/BRANT	526 500	259 487	265 356	531	1 608	12.2	19 567	5	11 825
NIAGARA	408 000	165 598	182 784	366	1 108	14.0	15 523	3	9 579
G.T.A.	5 594 600	3 307 818	3 448 065	6 896	18 638	10.2	190 110	18	99 167
FRONTENAC	137 100	69 388	66 768	134	405	18.7	7 576	3	4 675
OTTAWA-CARLETON	757 300	425 624	403 641	807	2 446	20.8	50 803	10	29 086
SUDBURY REGION	144 300	58 476	60 462	121	366	30.0	10 985	3	6 778
ALGOMA	129 800	52 957	55 035	110	334	49.1	16 372	3	10 102
THUNDERBAY	168 600	74 264	78 399	157	475	63.6	30 219	5	18 262
SUB-TOTAL	8 878 800	4 859 059	5 047 842	10 096	28 334	14.18	401 853	11.4	226 396
OTHER***	2 578 700	1 027 581	588 853	1 178	5 828	25.4	148 031	2.00	92 284
TOTAL	11 457 500	5 886 640	5 636 695	11 273	34 162	16.10	549 884	8.90	318 680

* HOME TO WORK TRIPS REPRESENT 33% OF THE TOTAL TRIPS ---- TRB 599.

** VEHICLE OCCUPANCY: INTERCITY - 1.800 ---- MENY, 1990.
URBAN - 1.400
TOTAL - 1.572

*** ALL OTHER RURAL AREAS ARE ASSUMED TO HAVE A T.M.S. OF 2 PER CENT.

NOTE:-AVG. TRIP LENGTH IS A WEIGHTED AVG. OF URBAN & RURAL TRIP LENGTHS.
-GTA's AVG. TRIP LENGTH TAKEN FROM T.T.S. 1986.

C.2.3 Measures for increasing the use of transit

Three different measures to increase the share of urban passenger transportation provided by transit are considered:

1) moderate transit mode share increase to 13 per cent resulting in a 5 per cent reduction in travel demand;

2) realistic transit mode share increase to 16 per cent resulting in a 8 per cent reduction in travel demand; and

3) optimistic transit mode share increase to 22 per cent resulting in a 14 per cent reduction in travel demand.

The impact of each of these measures on the Province is examined for potential energy savings, costs and fuel savings benefits. The results of the three scenarios are presented in Table C-14. Each measure is assumed to be implemented in 1995 and full benefits and costs occur in 2005. Total work trips and total person trips used to estimate the scenarios are the same as those presented in Table C-13.

Moderate transit share increase

A *moderate* increase in transit's share of urban passenger transportation by 2005 reflects transit ridership of approximately 25 per cent in both the Greater Toronto Area (GTA) and Ottawa-Carleton area. This level of ridership is expected with proposed transit service initiatives currently in the planning stage in these areas to 2005. This scenario also assumes a 50 per cent transit share increase in all other regions considered, except for the rural County of Grey, increasing the rural transit share from approximately 3 to 5 per cent of total daily work trips to 4.5 to 7.5 per cent.

The *moderate* transit mode share results in an increase of the regional transit share to 16 per cent and an increase in the total provincial transit share of urban passenger transportation to about 13 per cent (as compared to the base case scenario of 9 per cent transit share).

Realistic transit share increase

A *realistic* transit share increase by 2005 estimates transit ridership of approximately 30 per cent in both the GTA and Ottawa-Carleton, which reflects transit share policy goals consistent with transit service initiatives currently planned. The increase assumes that in other regions the transit share would increase to between 6 and 10 per cent, representing a doubling of the existing transit shares. The realistic transit share increase results in a transit share of 21 per cent for the regional areas examined and an Ontario transit share of 16 per cent (as compared to the base case transit share of 11 per cent and 9 per cent respectively).

TABLE C-14
ESTIMATED TRANSIT MODE SPLIT AND VEHICLE DEMAND BY SCENARIO AND REGION IN ONTARIO FOR 2006

	MODERATE SCENARIO		REALISTIC SCENARIO		OPTIMISTIC SCENARIO	
AREA	T.M.S. %	VEHICLE TRIP KILOMETRES* 000's	T.M.S. %	VEHICLE TRIP ILOMETRES 000's	T.M.S. %	VEHICLE TRIP KILOMETRES* 000's
GREY	2	3 862	2	3 862	4	3 783
ESSEX	8	12 042	10	11 717	15	11 066
LAMBTON	5	5 868	6	5 776	9	5 592
MIDDLESEX	8	14 346	10	13 958	15	13 182
WATERLOO/BRANT	8	11 514	10	11 203	15	10 580
NIAGARA	5	9 431	6	9 282	9	8 986
G.T.A.	25	90 701	30	84 654	40	72 561
FRONTENAC	5	4 602	6	4 530	9	4 385
OTTAWA-CARLETON	25	24 238	30	22 622	35	21 006
SUDBURY REGION	5	6 673	6	6 569	9	6 359
ALGOMA	5	9 946	6	9 790	9	9 477
THUNDERBAY	8	17 782	10	17 301	15	16 340
SUB-TOTAL	17	211 004	21	201 263	28	183 318
OTHER	2	92 284	2	92 284	4	90 400
TOTAL	13	303 288	16	293 547	22	273 718
Reduction in travel**		5%		8%		14%

NOTE:
* VEHICLE OCCUPANCY: INTERCITY - 1.800 ---- MENY, 1990.
URBAN - 1.400
TOTAL - 1.572
** REDUCTION IN TRAVEL DEMAND EQUALS THE RATIO OF FORECAST TRAVEL DEMAND (TABLE C-13) AND POTENTIAL TRAVEL DEMAND RESULTING FROM AN INCREASE IN T.M.S.

- AVG. TRIP LENGTH IS A WEIGHTED AVG. OF URBAN & RURAL TRIP LENGTHS.
- DAILY TRIP DATA FROM FORECAST 2006 (TABLE C-13).

Optimistic transit share increase

The third transit share increase represents an *optimistic* increase in the use of transit over the fifteen year period to 2006. A transit share of 40 per cent in the GTA and of 35 per cent in Ottawa-Carleton area are assessed. These, however, are more likely to evolve over a longer planning time frame reflecting changes in travel behaviour and efficient transit service in conjunction with higher land use densities. The remaining regional areas examined are assumed to have transit shares ranging from 9 to 15 per cent. This represents a tripling of the existing transit shares in these regions.

The increase in transit share results in a transit share of 28 per cent for the regions studied and an Ontario transit share of about 22 per cent (as compared to the base case scenario transit shares of 11 per cent and 9 per cent respectively).

Summary of transit share changes on future energy use

The effect of transit share changes estimated above for 2006 are assumed applicable to 2005 and the base case established for this study. The expected energy use savings in 1995, 2000 and 2005 are presented in Table C-15. The *moderate* transit share increase reflects an Ontario transit share of 13 per cent by 2005 which would result in the energy use from the base case of approximately 14 PJ/a. The *realistic* transit share increase would result in a reduction of approximately 22 PJ/a and the *optimistic* transit share would result in a reduction of about 38 PJ/a annually.

C.2.4 Costs and benefits of increased transit share

Cost assumptions

The costs associated with the different transit share measures are estimated by considering incremental annual ridership, operating costs and capital costs and typical transit system costs (CUTA, 1990.).

The total annual transit costs (in 1988 dollars) associated with an Ontario transit share of 9 per cent is presented for the base year 1988 and forecasted to 2005 based on an annual direct operating cost per capita of $150.92 and an annual capital cost per capita of $45.33. The total transit costs for Ontario, in 1988 were estimated at about $2,829 million (less operating revenue from riders).

Table C-15
Annual automobile and light truck energy use savings due to increased transit modal split.

Measure	Petajoules of energy use saved annually		
	1995	2000	2005
Moderate transit share, 13%	3	5	14
Realistic transit share, 16%	5	10	22
Optimistic transit share, 22%	8	16	38

The annual direct cost per capita reflects the direct cost of regular services and include the following operating expenses:

- salaries, wages and benefits
- services
- materials (including fuel)
- utilities
- liability costs
- licences
- taxes
- miscellaneous

The annual capita cost per capita reflect the net capital costs (excluding Municipal and Capital Subsidies) and include the following capital expenditures:

- Vehicle purchases (for both growth and replacement), plus
- Land and buildings, plus
- Rights-of-way and track, plus
- Other capital costs, minus
- Capital disposals

These capital expenditures are valued on an annual basis.

In addition to the estimated annual operating costs and annual direct capital costs, the province has committed funds towards a number of programs designed to improve public transit infrastructure and operation, as well as expanding service. The spending commitments include those under the "Let's Move - Transportation Solution for the 90's" program for the greater Toronto area and funds for the Region of Ottawa-Carleton. Through these programs it is estimated that approximately $6 billion will be spent over the life of these programs on the expansion of transit and Go Train service, the development of bus gateways into urban areas and the improvement of transit infrastructure and operation. These expenditures are included in the cost analysis. Much of the cost associated with the "Let's Move" program is for long term infrastructure, and thus the annual costs are assumed to be roughly equal to the cost of capital (i.e. 6%/a in constant dollars), or about $360 million.

Costs of an increased transit share

The cost of an increased transit share by 2005 consists of operating costs and annual capital charges. The assessment of capital costs includes an estimate of the number of transit vehicles required to accommodate the increased ridership using a ridership per transit unit relationship of 130,000 annual riders at an estimated cost of $250,000 per transit unit and annual expenditures of $360 million from committed provincial transit programs. Table C-16 and Table C-17 present the estimated incremental annual cost of the three transit share scenarios. A *moderate* increase in T.M.S. to 13 per cent is estimated to cost an additional $798 million per year in 2005. The *realistic* scenario is estimated to cost an additional $1,126 million per year in 2005 and the *optimistic* transit share is estimated to cost an additional $1,783 million per year in 2005.

Table C-16
Estimated total annual cost of an increase in transit share

Measure	Transit Share in 2005 (%)	(10^6 1988$)		
		1995	2000	2005
Moderate	13%	$448	$535	$798
Realistic	16%	$552	$743	$1,126
Optimistic	22%	$665	$970	$1,783

Note: See Table C-17 for a detailed breakdown of the cost estimates.

C.2.5 Fuel savings benefits from an increase in the transit share

The fuel savings benefit resulting from an increased transit share by 2005 are based on the MENY Energy Price Model for gasoline and diesel fuels and the fuel savings estimated from urban automobiles and light trucks resulting from the share.

The fuel savings benefits for the Province of Ontario are presented in Table C-18. The annual value of fuel saving benefits in 2005 are approximately $218 million for increasing the transit share for Ontario from 9 per cent to 13 per cent reflecting the *moderate* transit share increase. The fuel savings benefit of increasing the Ontario overall transit share from 9 per cent to 16 per cent (*realistic* transit share increase) is estimated to be approximately $349 million. The benefit in fuel savings of the *optimistic* transit share increase (increasing the Ontario transit share from 9 per cent to 22 per cent) is estimated at approximately $610 million.

Table C-17

The incremental annual costs of moderate, realistic and optimistic transit measures

	1988	1990	1995	2000	2005
Moderate Scenario					
Increase in ridership (thousands)	0	0	78,466	156,933	392,332
New vehicles required	0	0	604	1,207	3,018
Annual cost of new vehicles	$0	$0	$14	$29	$72
Incremental annual direct operating costs (M$)	$0	$0	$105	$210	$525
Incremental annual capital costs (M$)	$0	$0	$32	$63	$158
Total incremental cost (M$)	$0	$0	$151	$302	$755
Incremental revenue (M$)	$0	$0	$63	$127	$317
Present transit funding commitments (M$)	$0	$0	$360	$360	$360
New incremental cost (M$)	$0	$0	$448	$535	$798
Realistic Scenario					
Increase in ridership (thousands)	0	0	171,645	343,290	686,581
New vehicles required	0	0	1,320	2,641	5,281
Annual cost of new vehicles	$0	$0	$32	$63	$126
Incremental annual direct operating costs (M$)	$0	$0	$230	$460	$919
Incremental annual capital costs (M$)	$0	$0	$69	$138	$276
Total incremental cost (M$)	$0	$0	$330	$661	$1,321
Incremental revenue (M$)	$0	$0	$139	$278	$555
Present transit funding commitments (M$)	$0	$0	$360	$360	$360
New incremental cost (M$)	$0	$0	$552	$743	$1,126
Optimistic Scenario					
Increase in ridership (thousands)	0	0	273,231	546,462	1,275,078
New vehicles required	0	0	2,102	4,204	9,808
Annual cost of new vehicles	$0	$0	$50	$100	$234
Incremental annual direct operating costs (M$)	$0	$0	$366	$732	$1,707
Incremental annual capital costs (M$)	$0	$0	$110	$220	$513
Total incremental cost (M$)	$0	$0	$526	$1,052	$2,454
Incremental revenue (M$)	$0	$0	$221	$442	$1,031
Present transit funding commitments (M$)	$0	$0	$360	$360	$360
New incremental cost (M$)	$0	$0	$665	$970	$1,783

Notes: Increased ridership and costs are based on CUTA 1988 *Operating Costs* data extrapolated to 2005 based on the implicit MENY Model annual growth rate (1.36%). Ridership for 2005 is forecasted at 8 83 million. New vehicles cost $250,000 and have a 17 year economic life, and a real interest rate of 6 per cent.

Table C-18
Transit fuel savings benefits (1988 k$).

Measure	Annual Savings Benefits (10^6 1988$)		
	1995	2000	2005
Moderate transit share	$40	$81	$218
Realistic transit share	$79	$162	$349
Optimistic transit share	$118	$244	$610

Note: In addition to these fuel savings, other benefits, such as decreased emissions and congestion might be expected, but these are not estimated in economic terms.

C.2.6 Conclusion

Based on a regional analysis of present and future work trips in Ontario three different possible transit shares for the year 2005 are considered:

- moderate transit share of 13 per cent, resulting in a 5 per cent decrease in urban automobile and light truck travel demand;
- realistic transit share of 16 per cent, resulting in a 10 per cent decrease in urban automobile and light truck travel demand; and
- optimistic transit share of 22 per cent, resulting in a 14 per cent decrease in urban automobile and light truck travel demand.

The increases in transit share correspond to a decrease in energy use in the transportation sector of between 14 and 38 PJ/a by 2005. The estimated annual cost to implement the measures necessary to reduce travel demand through increasing the transit share range from between $800 million (5 per cent reduction) to $1,800 million (14 per cent reduction) in 2005. The estimated annual fuel saving benefits due to reduced travel demand is estimated at between $220 and $610 million per year for a 5 per cent and a 14 per cent reduction in private vehicle travel demand, respectively. Other benefits will also accrue, but the value of these benefits has not been assessed.

Appendix C.3 Economic instruments—fuel and gas guzzler taxes

In most countries, fuel economy targets and emission standards for motor vehicles are set through regulatory instruments implemented through government legislation. This command and control approach usually includes some system of monitoring and sanctioning for non-compliance. For example, government regulators set a fleet fuel efficiency target for a given year; if this target is not met, motor vehicle manufacturers face a fine or penalty. The objective of this regulatory approach is to force manufacturers to integrate new fuel efficiency or emission reduction standards into the new year motor vehicle fleet. Over time, the fuel efficiency of the entire motor vehicle fleet is increased. In Canada, motor vehicle fuel efficiency standards are voluntary and emissions are regulated using the direct approach.

The setting of such standards and targets has several advantages; it is fairly easy to administer, the effects of the regulation are known, regulation does not cause negative distributional effects or severely affect the disadvantaged, and is a highly visible policy instrument (Opschoor, 1989:24). In addition, manufacturers also like regulations since it provides them an opportunity to negotiate the target levels with policy-makers. However, the command and control approach also has several disadvantages: (Opschoor, 1989:24)

- motor vehicle manufacturers have no incentive to exceed the fuel efficiency or emission standards set in the regulation;
- consumers have no incentive to purchase fuel efficient or "clean burning" motor vehicles;
- compliance is required from the manufacturer and not the consumer;
- regulations limit the ability of policy-makers to integrate energy or environmental policy objectives with other policy objectives;

- the application of regulatory standards implies that an acceptable level of control is achieved;

- the cost of achieving the standards set in the regulation may vary widely between manufacturers and regions; and

- the regulation may not achieve its objective due to market failures or poorly defined regulatory requirements.

Given these drawbacks, alternative, indirect policy tools for achieving fuel efficiency and emission targets are being developed. A major focus of this research has been on the use of market instruments to alter consumer and producer behaviour. One market instrument excluded from this study is emissions trading from non-stationary sources because such trading has not yet been successfully implemented for non-stationary sources.

This report is organized as follows: Section C.3.1 provides an overview of the advantages and disadvantages of using market instruments for energy and environmental policy; Sections C.3.1 to C.3.4 review market incentives applicable to the motor vehicle sector; and Section C.3.4 provides conclusions on the applicability of market instruments.

C.3.1 Overview of market instruments

Market instruments are defined as the price consumers and producers are required to pay by the government to either raise revenue, possibly to provide environmental services, or act as an incentive to alter the behaviour of polluters (Opschoor, 1989:14). These instruments serve as a tool for implementing policy objectives without the imposition of legislated requirements. Examples of market instruments include: charges (taxes); subsidies; deposit-refund systems; market creation mechanisms; and financial enforcement incentives.

Market instruments offer a number of advantages over the traditional command and control approach: (Opschoor, 1989:111–112)

- environmental or energy policy is internalised into the behaviour of consumers and manufacturers;

- raise revenue for environmental or other government policies;

- offer an inducement to producers to continually develop more fuel efficient or cleaner burning motor vehicles; and

- encourage the achievement of environmental or energy policy efficiently and at the least cost to society.

The use of market instruments permit governments to achieve environmental quality or fuel efficiency standards and targets through the allocative efficiencies which exist in the market place. In addition, market instruments transfer wealth from the polluter to the government. This wealth can be used by government for the improvement of the environment without the need for real resource expenditures (Barrett, 1990:11–12).

Critics, however, have identified several problems with the use of market instruments for environmental or energy policy. One problem is that market instruments have the potential to be administratively expensive; although they also generate revenue which can finance the higher costs. Market instruments also imply that a deregulatory action has occurred. The public and environmental groups are distrustful of deregulation since it infers that the polluter is provided with the right to pollute. However, market instruments do not require deregulation to be effective; they are an alternative policy tool to achieve legislated fuel efficiency improvements or emission reductions.

The use of market instruments for changing fuel efficiency or emission standards in motor vehicle fleets is usually done through the altering of the relative cost of purchasing, operating or both of motor vehicles. Taxes are added to the operating or purchasing costs of the vehicle in an attempt to deter the use of vehicles which fail to meet the legislated targets. Financial incentives, or negative taxes, encourage motor vehicle owners or producers to switch to new products consistent with policy objectives.

C.3.2 Market instruments and transportation

Taxes on motor vehicle fuel or ownership are usually applied by governments to generate revenue. In Ontario, both the Federal and Provincial governments apply taxes to motor vehicle fuels (Table C-19). These fuel taxes are levied to generate revenue (Bleviss, 1988:162). However, an indirect effect of these fuel taxes is that they act as an incentive for consumers to purchase fuel efficient motor vehicles.

Other taxes are also levied on motor vehicles in Ontario. The Federal government charges an excise tax of $100 for each car, van or truck sold with an air conditioner unit: The Province levies a tax of $5 per tire to improve the management of scrap tires; an annual license and registration fee per vehicle of $66,[1] and levies a surtax on fuel inefficient passenger cars.[2] These taxes on motor vehicles also may create incentives for changing consumer and producer behaviour towards more fuel efficient or cleaner burning motor vehicles.

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1 The annual license and registration fee in the greater Toronto area is $90 and $33 in northern Ontario.

2 Personal communication with Craig Willis, Transportation Energy and Productivity Office, Ontario Ministry of Transportation, February, 1991.

Table C-19
Motor vehicle fuel taxes in Ontario

Fuel type	1990 fuel price, including taxes (¢/L)	Provincial tax - gasoline and fuel taxes (¢/L)	Federal tax - excise and sales taxes*** (¢/L)	Total taxes on motor vehicle fuels (¢/L)
Gasoline - regular unleaded	56.68*	11.30	12.89	24.19
Gasoline - leaded	n.a.	14.30	n.a.	n.a.
Diesel	48.84*	10.90	8.04	18.94
Propane	36.3**	4.30	0.83****	41.43
Aviation	n.a.	2.10	n.a.	n.a.

* - Simple average of fuel prices from across the province for 1990.
** - Simple average automotive propane price, 16 urban centres in Ontario, April, 1990 to February, 1991.
*** - Sales tax equals 13.5 per cent of cost of fuel except propane; seventeen per cent of total sales taxable at 13.5 per cent.
**** - There is no excise tax on propane.
n.a. = Not available

Note: Ontario gasoline and fuel taxes are for 1990. Federal excise and sales taxes are as of October 1, 1990. Personal communications with Bob Moxley, Director, Motor Fuels and Tobacco Tax Branch, Ontario Ministry of Revenue, Spencer Knipping, Oil and Gas Section, Ontario Ministry of Energy, October, 1990, Martin Whicher, Energy Programs and Technology Branch, Ontario Ministry of Energy, November, 1990 and Ladan Mahboodi, Ontario Ministry of Energy, February, 1991.

C.3.3 Fuel taxes

Taxes on fuels can create an incentive for a change in the traditional buying, operating and selling behaviour of consumers or producers. The objectives of such taxes are to either improve energy efficiency in the sector, encourage fuel switching, or reduce pollutant emissions. The effectiveness of such taxes requires that (Harrison, 1990:16):

- the tax is based on the increase in fuel efficiency or emissions reduction desired so the tax burden decreases as the objective of the tax is achieved; and

- the marginal charge must be big enough to affect the behaviour of consumers and producers in the market place.

The use of taxes on fuels as an incentive has several advantages: (Barrett, 1990a:10–12)

- the cost of achieving the policy objective is lower than through direct regulation;
- motor vehicle producers are encouraged to expand their energy efficiency and emissions research and development programs; and
- although significant revenues are collected by the government, there is no net cost to society since taxes do not lower national income but redistribute it.

An example of a fuel tax which induces change in consumer and producer behaviour is a threshold tax imposed on the price of gasoline. If the market price for gasoline is below the threshold level, a tax is imposed up to the price desired. If the price is at or above the threshold no tax is applied. Over time, the threshold level could be changed to reflect changes in policy objectives.

Taxes on fuel as a market instrument have several disadvantages. If the tax takes the form of a threshold tax, administrators must determine what the threshold level would be to create the desired consumer response. Once the tax threshold level is determined continual monitoring is required to ensure that the tax remains effective.

Of greater concern is the long term effectiveness of fuel taxes. Typically, the objective of the tax is to encourage car owners to purchase fuel efficient motor vehicles. Initially the fuel tax results in higher operating costs for car owners. Over time car owners will purchase more fuel efficient vehicles to lower their operating costs. However, increased prices for motor fuel have a diminishing effect on normal operating costs for car owners as the fuel economy of the motor vehicle increases (von Hippel, 1983:113–114). The car owner who has purchased a fuel efficient vehicle which requires no greater relative expenditure for fuel purchase than prior to the implementation of the tax has less incentive to purchase an even more fuel efficient vehicle. In the United States the effectiveness of a fuel tax is estimated to diminish once the consumer owns a car that achieves about 7.84 litres per 100 km (30 miles per U.S. gallon) (Bleviss, 1988:162–163) An increase in the tax on fuels is only a partial solution to this problem since the effectiveness of the tax diminishes as the fuel efficiency increases.

Finally, fuel taxes which encourage the purchase of highly efficient motor vehicles may result in increased emissions of pollutants (Khazzoom, 1990:457). As the fuel efficiency of motor vehicles increases the marginal cost per kilometre driven lowers, resulting in an increase in the demand for travel. Since many emissions limits are set on the basis of distance travelled (e.g. g/km), the greater amount of travel may increase emissions.

Green taxes or carbon taxes

Fuel taxes could be adjusted to reflect the relative environmental cost of the fuel. Such taxes on fuel are often called green taxes or carbon taxes. The green tax varies depending on the content of a pollutant and encourages the purchase of motor vehicles or the switching to alternative fuels with lower emission levels of the pollutant. Green taxes are used in some European countries to encourage consumers to switch from leaded to unleaded gasoline (Oschpoor, 1989:35). In Ontario a differentiated fuel tax between leaded and unleaded gasoline was instituted in 1988 to discourage misfueling vehicles designed for unleaded gasoline. Its effectiveness as a green tax, however, is unknown due to the subsequent accelerated phasing out of leaded gasoline.

The application of a green tax is not administratively difficult since most countries already have some form of fuel tax to which the green tax could be added. However, it is not clear how one determines the appropriate value of a green tax. For example, a number of proposals for a carbon tax on fossil fuels have been advocated in recent years. The estimated value of such a tax, achieving a significant reduction in carbon emissions, varies between 4 dollars and 860 dollars (1988 Cdn) per tonne of carbon.[3]

To achieve stable carbon dioxide emissions by 2000 at 1988 levels or a 20 per cent reduction in carbon dioxide emissions by 2005 from 1988 levels from motor vehicles in Ontario a simple estimate can be made of the required level of a carbon tax. For representative purposes only, the level of a carbon tax on gasoline and the aggregated total carbon tax based on the MENY model to achieve a twenty per cent reduction in carbon dioxide emissions by 2005 and stable carbon dioxide emissions by 2000 and are presented in Table C-20 and Table C-21 respectively. The potential level of carbon taxes for 1995, 2000 and 2005 are presented. The tax is applied to inter-city aviation, automobiles and light trucks, commercial and freight trucks, and marine vessel energy use as well as all urban and other transport modes excluding public transit. The inclusion of all motor fuels or of all carbonaceous fuels would change the required tax.

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[3] The range of estimated carbon taxes represents different assumptions regarding the initial year and price of oil, emission reduction objectives and region to which the tax is applied. See, Barrett, 1990a:15-31 and Barrett, 1990b:4-10. Assuming 642.6 grams of carbon per litre of gasoline this is equivalent to a 0.2 cents to 55 cents (1988 Cdn) increase in the price per litre.

Table C-20
Estimated carbon tax required to achieve a twenty percent reduction from 1988 CO_2 emissions by 2005.

	1995	2000	2005
Reduction in fuel consumption	10%	23%	38%
Tax as a per cent of fuel price*	29%	66%	109%
Including current taxes			
Forecast fuel price including current fuel taxes (1988 Cents/Litre)	53.94	54.51	55.81
Proposed carbon tax (1988 cents/litre)	15.41	35.89	60.83
New fuel price including all taxes (1988 cents/litre)	69.35	90.40	116.64
Carbon tax (1988$/tonne CO2)**	$65	$152	$258

Note:

* - Assumes a price elasticity of demand for fuel consumption of -0.35. Tax required as a per cent of fuel price equals the fuel consumption reduction target divided by the absolute value of the price elasticity. Per cent numbers are rounded.

** - Based on 67.98 grams of carbon dioxide per litre of gasoline.

Table C-21
Estimated carbon tax required to achieve stable 1988 CO_2 emissions by 2005.

	1995	2000	2005
Reduction in fuel consumption	8%	18%	18%
Tax as a Per Cent of Fuel Price*	8%	31%	31%
Including current taxes			
Forecast Fuel Price Including Current Fuel Taxes (1988 Cents/Litre)	53.94	54.51	55.81
Proposed Carbon Tax (1988 Cents/Litre)	4.24	16.95	17.36
New Fuel Price Including all Taxes (1988 Cents/Litre)	58.18	71.46	73.17
Carbon Tax (1988$/Tonne CO2)**	$18	$72	$74

Note:

* - Assumes a price elasticity of demand for fuel consumption of -0.35. Tax required as a per cent of fuel price equals the fuel consumption reduction target divided by the absolute value of the price elasticity. Per cent numbers are rounded.

** - Based 67.98 grams of carbon dioxide per litre of gasoline.

The price elasticity of demand chosen, -0.35, reflects a moderate long term price elasticity of demand based on a survey of the literature.[4] Lower price elasticities of demand (-0.35 to -0.1) reflect the level of a carbon tax required in the short term to achieve a policy objective; the level of taxation required over a shorter period of time to achieve the policy objectives would be higher. Higher price elasticities (-0.35 to -1.0) of demand reflect the level of a carbon tax for achieving the policy objective over a longer period of time; the carbon tax required would be lower.

The estimated carbon tax to achieve a 20 per cent reduction in carbon dioxide emissions by 2005 (Table C-20) is $258 per tonne of carbon dioxide in 2005. This would add 61 cents to the price of a litre of gasoline by 2005.

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[4] The range of price elasticities examined for the study reflect the estimated price elasticities from a number of studies. See: Ontario Ministry of Energy, 1988 estimates of the short term price elasticity of demand; Greene, 1990; Dahl, 1986; Sandbach, 1988; Hsing, 1990; and Drollas, 1984.

The estimated carbon tax to achieve stable 1988 levels of carbon dioxide emissions by 2000 is about $72 per tonne of carbon dioxide in 2000 (Table C-21) or an additional 17 cents per litre of gasoline.

The expected reduction in energy use resulting from the carbon taxes is presented in Table C-22. To achieve stable carbon dioxide emissions by 2000 at 1988 levels overall fuel consumption must drop 18 per cent by 2000. A 20 per cent reduction in carbon dioxide emissions from 1988 levels by 2005 requires a 38 per cent reduction by 2005. This corresponds to a rate of fuel consumption of 6.03 L per 100 km for the entire gasoline automobile fleet in 2005.

The total transportation sector energy savings as a result of the carbon tax are presented in Table C-23. The energy savings resulting from the adoption of a fuel tax to achieve the objective of 1988 carbon dioxide emission levels by 2000 are estimated at about 130 PJ/a in 2000. A carbon tax which achieves a 20 per cent reduction in carbon dioxide emission from 1988 levels by 2005 is estimated to save about 390 PJ/a in 2005.

In addition, a reduction in travel demand is also assumed as a result of the carbon tax. The carbon tax applied to achieve stable carbon dioxide emissions at 1988 levels by 2000 is expected to achieve about a 2 per cent reduction in travel demand. The carbon tax applied to achieve a 20 per cent reduction in 1988 carbon dioxide emission levels by 2005 results in a 5 per cent reduction in travel demand by 2005.[5]

Table C-24 presents a survey of the proposed level of carbon taxes in other jurisdictions and their emission reduction objectives. These carbon taxes range from $3 to almost $800 (U.S.) per tonne. The level of carbon taxes discussed in this report to achieve a 20 per cent reduction in carbon dioxide by 2005 is about $258 (Cdn) or about 109 per cent of the 2005 forecast price of gasoline. This simple estimate of a possible carbon tax for Ontario, based only on the price of gasoline, is generally higher than the carbon taxes estimated in studies which examined the 20 per cent reduction from 1988 levels presented in Table C-24.

More sophisticated analysis which considered all carbon emitting sources, alternative fuels, consumer income and capital substitution for Ontario is expected to lower the carbon tax estimated in this study (Barrett, 1990:17). Such analysis may result in the estimation of a carbon tax for Ontario consistent with estimates of similar taxes in other jurisdictions. As such, the carbon tax discussed in this study is for illustrative purposes only. Further study is required to determine the level, extent and impact of a carbon tax applied at a provincial, or national, level.

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[5] Price elasticity estimates do not provide information on how much of the response is attributable to efficiency improvements and how much is attributable to demand reductions. However, several studies suggest that travel demand by automobile (km/a) is quite inelastic (Bleviss, 1988:164).

Table C-22
Estimated Reduction in fuel consumption in per cent — all transport modes to achieve scenario objectives

Year	**Stable carbon dioxide Emissions by 2000 at 1998 levels**	**Twenty per cent reduction in carbon dioxide emissions from 1988 levels by 2005**
1995	8%	10%
2000	18%	23%
2005	18%	38%

Note: Percentages are reductions required relative to the base case.

Table C-23
Total transportation sector energy use savings—all transport modes

Year	Stable Carbon Dioxide Emissions by 2000 at 1998 levels (PJ/a)	Twenty Per Cent Reduction in Carbon Dioxide Emissions from 1988 Levels by 2005 (PJ/a)
1995	53	66
2000	128	162
2005	137	289

Table C-24
Survey of Studies on Carbon Taxes and their Effects on Carbon Emissions Reduction

Source	Carbon Tax (US$ per Tonne)	Per Cent of Oil Price	Emission Reduction	Region
Nordhaus (1989)	$3	2%[1]	9% in 2050	World
	$41	23%[1]	28% in 2050	World
Barrett (1990)[2]	$37[3]	32%[4]	20% in 1988	United Kingdom
	$65[3]	57%[4]	20% in 1988 by 2050	United Kingdom
Ingham and Ulph (1989)	$96 – $226[5]	57% – 128%	20% in 1988 by 2050	United Kingdom Manufacturing
Bye, Bye and Lorensten (1989)	$139[5]	75%[6]	20% in 2000	Norway
	$139[5]	75%[6]	0% relative to 1987	Norway
Manne and Richels (1989)	$772 at peak[7]	444%[1]	600% in 2100	United States
	$331 in long run	190%[1]	20% relative to 1985	United States
Cline (19899)	$174[5]	100%	57% in 2050 21% relative to 1985	World
Edmonds and Reilly (1983)	$136[5]	78%	40% in 2050 -204% relative to 1985	World
Howarth, Nikitopoulus and Yohe (1989)	$687 in 2050 small GDP effect[9]	103%[8]	26% in 2050 -95% relative to 1985	World
	$600 in 2050 large GDP effect[9]	103%[8]	47% in 2050 -40% relative to 1985	World
U.S. EPA (1989)	$68[5] in 2050	39%[1]	45% in 2025 14% relative to 1985	World
	$179[5] in 2050	103%[1]	55% in 2025 12% relative to 1985	World
Kram and Okken (1989)	$50 in 2020	5% – 10%[10]	50% in 1988	Netherlands

Source: Barrett, 1990.

Notes:

1. Calculated relative to crude oil at, $20 (US) per barrel.
2. Revised from previous estimates.
3. Assumes an exchange rate of $1.60(US) per £.

4. Relative to the 1988 price of imported oil, £62 per tonne or about $13 per barrel. The second estimate assumes that emissions in 2005 need to be reduced by 35% if the 1988 level of emission is to be reduced by 20%. Ingham and Ulph's (1989) upper bound estimates assumes that emissions would have to be reduced by almost 50% in 2005 to achieve the same target.
5. Calculated for crude oil at, $20 (US) per barrel.
6. Bye, Bye and Lorensten (1989) predict that oil prices will be 5% higher in 2000 if there were no carbon tax. Hence the carbon tax amounts to 75% of the price of oil in 2000, or 80% of the price in 1987.
7. The tax is first applied in 2000 at just over $110 per tonne, and reaches a peak in 2020.
8. The authors apply a 100% tax to a composite of fuels having an average carbon content of 929 kg of carbon per tonne of oil equivalent (or 19.8 gC per kBtu). The 103% tax was found by adjusting the 100% tax for the average carbon content of oil (20.3 gC per kBtu). These tax rates are based on prices corresponding to the carbon tax case. Without the carbon tax, the price of energy would be higher--50% higher when the GDP effect is "small" and 31% higher when the effect is "large" compared to the cases where there is no carbon tax.
9. The price of oil in 2050 is predicted to be $79 per barrel when the GDP effect is "small" and $69 per barrel when the effect is "large".
10. Relative to prices in 2050. This is equivalent to a 28% tax on the current price of oil.

C.3.4 Ownership or gas guzzler taxes

Ownership taxes can be applied at two levels, the time the motor vehicle is purchased, and through annual motor vehicle licensing and registration. In Ontario, ownership taxes are applied to motor vehicles for licensing and registration, on tires, air conditioning and fuel inefficient passenger cars.

Taxes on vehicle ownership whose objective is to alter market behaviour are usually progressive; increasing according to the vehicles weight, engine-cylinder capacity, fuel efficiency or emissions rating (Bleviss, 1988:164-165). These taxes may also vary with the year of purchase or by the type of fuel the vehicle uses. Progressive ownership taxes are considered to be relatively easy to implement and administer.

The degree to which the tax varies according to the policy objective determines the effectiveness of ownership taxes. Many countries already have motor vehicle ownership taxes, however, the level of and degree of progressiveness of these taxes are ineffective for altering consumer behaviour. In such instances ownership taxes serve as a means to generate revenue for the government or cover the administrative costs of vehicle registration and licensing.

Ontario's gas guzzler tax

In Ontario, the tax on fuel inefficient passenger cars acts as an incentive to encourage the purchase of fuel efficient motor vehicles. The surtax applies to passenger vehicles, excluding vans and light-trucks, with poor fuel economy. The amount of the tax is determined by how far a vehicle's Transport Canada rated fuel efficiency is above the fuel economy threshold of 9.5 L/100 km highway rating. The level of these taxes on July 1, 1989 are shown on Table C-25.

To achieve a reduction of new passenger vehicle fuel consumption of 30 per cent, 35 per cent and 40 per cent the effective level of a gas guzzler tax must achieve new fleet passenger vehicle efficiency levels by 2005. The new fleet combined urban and highway fuel efficiency standard reflects the estimated reduction in fuel consumption achievable through new CAFE standards (See, Table C-4). These new standards are listed on Table C-26 and result in an overall reduction in passenger vehicle fleet fuel consumption of 20 per cent, 26 per cent and 32 per cent, reflecting low, high and medium levels of the adoption by motor vehicle operators of more fuel efficient vehicles as a result of the tax.

The gas guzzler tax is also applied to commercial and heavy trucks resulting in a reduction in fuel consumption of 10 per cent, 13 per cent and 14 per cent for the three levels of implementation.

Table C-25
Ontario's gas guzzler taxes.

Fuel Consumption Rating (L/100 km)	Tax rate (1989$)
9.5 - 12.0	$ 600
12.1 - 15.0	$1 200
15.1 - 18.0	$2 200
over 18.0	$3 500

Table C-26
Required new passenger vehicle fleet fuel economy.

New passenger vehicle fleet fuel consumption reduction relative to 1988 (%)	New passenger vehicle fleet fuel consumption objective (L/100 km)	Passenger vehicle fleet fuel consumption in 2005 (L/100 km)
30% fuel consumption reduction	7.28	7.59
35% fuel consumption reduction	6.76	7.05
40% fuel consumption reduction	6.24	6.51

For illustrative purposes only the level a gas guzzler tax to achieve the targeted reduction in passenger vehicle fuel consumption was estimated. The estimated tax rate to achieve these fuel efficiency standards for passenger vehicles, assuming a price elasticity of demand of -0.35 is presented in Figure C.1 and in Table C-27. The tax rate varies with the rated combined urban and highway fuel efficiency of the passenger vehicle and the reduction in fuel consumption objective and is calculated in dollars as follows:

$$\frac{(L/100km - L/100km^*) \times \left[\frac{\left(1 - \frac{L/100km^*}{L/100km}\right)}{0.35}\right] \times 80{,}000 \times 55.81}{100}$$

where, L/100 km is the combined urban and highway rated passenger vehicle fuel consumption and L/100 km* is the target objective rate of fuel consumption found in Table C-26, and 0.35, 80 000 and 55.81 are the price elasticity of demand for fuel consumption, the expected kilometres travelled by a passenger vehicle over five years and the forecast price of gasoline in 2005 respectively.

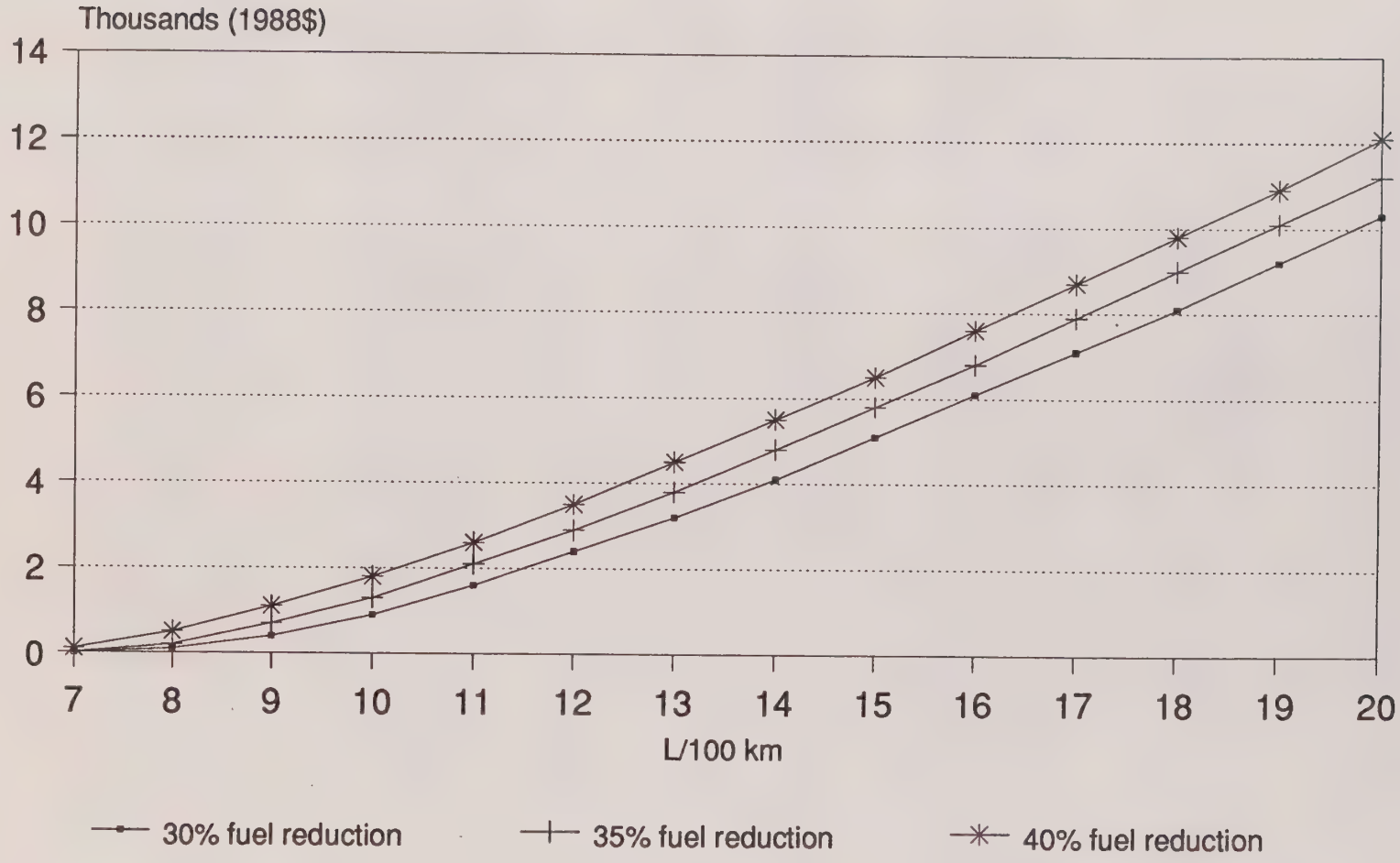
For example, to achieve a 30 per cent reduction in fuel consumption, a gas guzzler tax of $ 900 is applied to passenger vehicles with a combined rated fuel efficiency of 10 L/100 km while a $ 6,100 tax is applied on a vehicle with a combined rated fuel efficiency of 16 L/100 km.

C.3.5 Conclusion

Market instruments can be an efficient tool for creating changes in the behaviour of consumers and producers. Fuel and ownership taxes provide an incentive for consumers and producers to shift towards more fuel efficient or cleaner burning vehicles. However, regulatory standards and goals are still needed to apply these instruments. As such market instruments are an alternative tool which can enforce legislation more efficiently than traditional command and control approaches.

Market instruments also result in inequities. Taxes on motor vehicle fuel and ownership would be a greater burden to lower income groups, adversely affect other sectors of the local economy, such as tourism, and create an incentive for people near the border to go South to buy gasoline. As such, taxes on vehicles as an incentive for energy efficiency or environmental quality must be applied in conjunction with other policy objectives which minimize these inequities.

Figure C.3.1 Estimated gas guzzler tax
for gasoline passenger vehicles



Note: Based on passenger vehicles combined urban and highway fuel efficiency rating; for illustrative purposes only.

Table C-27
Estimated gas guzzler taxes for passenger vehicles to achieve a 30, 35 and 40 per cent reduction in fuel consumption

Gas guzzler tax in 2005			
Passenger vehicle's rating (L/100 km)	**30 per cent reduction in fuel consumption**	**35 per cent reduction in fuel consumption**	**40 per cent reduction in fuel consumption**
8	$100	$200	$500
10	$900	$1300	$1,800
12	$2400	$2900	$3,500
14	$4100	$4800	$5,500
16	$6100	$6800	$7,600
18	$8100	$9000	$9,800
20	$10 300	$11 200	$12,100

Note: The gas guzzler tax is calculated assuming:

- price elasticity of fuel consumption, - 0.35;
- price of gasoline, 55.81 ¢/L in 2005;
- average passenger vehicle life of 5 years and 167 000 km/a (80 000 km travelled over five years); and
- fuel consumption objectives presented in Table C-26.

The tax is estimated using the following equation:

$$T_{gg} = (V_r - T_r) \, X \, (1 - T_r / V_r) / E_p \, X \, D_t \, X \, F_p$$

where,

T_{gg} is the gas guzzler taxd ($),
V_r is the vehicle's fuel rating (L/100 km),
T_r is the target fuel rating (L/100 km),
E_p is the price elasticity,
D_t is the distance travelled over five years (km) and
F_p is the fuel price ($/L).

Carbon taxes are applied to achieve two scenario objectives in this study.

- A tax resulting in an 18 per cent reduction in the provincial fleet fuel consumption by 2000 to maintain carbon dioxide emissions at 1988 levels. The estimated fuel savings in 2000 is 130 PJ/a.

- A tax resulting in a 38 per cent reduction in the provincial fleet fuel consumption by 2005 to lower carbon dioxide emissions 20 per cent from 1988 levels. The estimated fuel savings in 2005 is 289 PJ/a.

For this study the use of a gas guzzler tax to reduce fuel consumption is assumed equivalent to the application of new CAFE standards.

- A low scenario reducing fuel consumption 20 per cent or 105 PJ/a by 2005.

- A medium scenario reducing fuel consumption 26 per cent or 137 PJ/a by 2005.

- A high scenario reducing fuel consumption 32 per cent or 164 PJ/a by 2005.

The potential cost and revenues from either a carbon tax or a gas guzzler tax in the Province were not estimated since the tax rates calculated in this study are for illustrative purposes only.

Appendix C.4 Transportation and land-use

Transportation is required to get people from where they are to where they want to be. The fact that they are not already where they want to be indicates an inadequacy. The farther they are from where they want to be, the greater this inadequacy, and the greater the need for transportation.

The pattern of land-use is a key determinant to how close people are to where they wish to be, and how much transportation they require. In addition, land use patterns affect the viability of particular modes of transport. For example, bicycling or walking is more practical where distances are short than where they are long; automobiles may be the only option where distances are long and few other people are travelling in the same direction at the same times.

There are two key characteristics of land-use that affect transportation demand: the *density* of population occupying the land, whether residential or employment related, and the *distribution* of different land uses. The importance of density is quite obvious: the higher the density, the higher number of possible destinations within a given distance from any point. Distribution affects the distance to the specific destinations one is going to. For example, if workplaces, schools, shopping facilities and other destinations are distributed throughout the community, then they are probably going to be closer to trip origins (e.g. homes) than they would be if all the workplaces were concentrated in one area, all the schools in another and so on.

C.4.1 Density and distance

Increasing density will decrease the distance required to reach the same number of destinations, and hence will reduce transportation demand. This is evident in both considerations of alternative development plans (Table C-28) and from observations of other cities with comparable quality of life to that in Ontario (Table C-29).

C.4.2 Distance and mode

By decreasing the distance that needs to be travelled, a second benefit beyond the savings associated with the need to travel shorter distances is the increased potential for travelling by different, more energy efficient modes.

Table C-28
Transportation energy implications of alternative development patterns

Community development pattern	Population density[a] (persons/ha)	Gasoline use (relative to low density sprawl)[b]
Low density sprawl	17.8	100%
Low density planned	19.8	81%
Planned mix	26.8	63%
Combination mix, 50% Planned Urban Development, 50% sprawl	28.0	75%
Sprawl mix	29.3	90%
High density planned	37.5	50%

Notes: [a] population per hectare of developed area (calculated from RERC, 1974:92)
[b] calculated from RERC, 1974:147.

As the length of a trip decreases, walking and bicycling become more and more attractive. An illustration of this is presented in Table C-30 which indicates how mode and distance relate.

Table C-29
The relationship between transportation energy use and density for selected cities

	Housing density (persons/ha)	Employment density (jobs/ha)	Land use intensity (pop.+jobs/ha)	Gasoline (MJ/person)
Toronto	39.6	19.7	59.3	34813
Frankfurt	54	43.2	97.2	16093
Zurich	53.7	32.5	86.2	15709
Stockholm	51.3	34.4	85.7	15574
Brussels	67.4	42.1	109.5	14744
Munich	56.9	34.2	91.1	12372
West Berlin	63.6	26.6	90.2	11331
Vienna	72.1	38.4	110.5	10074
Amsterdam	50.8	19	69.8	9171
Tokyo	104.6	66.3	170.9	8488

Table C-30
Modal share of bicycling and walking by trip length and purpose

Distance	Work	School	Shop	Total
2 km	92.7%	91.8%	94.4%	93.6%
4 km	81.1%	70.0%	72.9%	76.9%
6 km	51.3%	37.2%	32.8%	36.3%
8 km	12.6%	4.9%	3.3%	17.5%
12 km	4.7%	0.0%	0.0%	11.0%

Source: Replogle, 1983.
Notes: Data for Japan, 1975. Total trips accounts for trips other than just work, school and shopping.

C.4.3 Density and mode

As density increases, so does the use of less energy intensive (than private automobiles) transportation modes. Beyond the obvious correlation between density and distance, this reflects the increasing viability of public transit when there are more people wanting to go in a particular direction. At 2000 persons per square kilometre, public transit is not viable; at 8000 persons per square kilometres, public transit can generate revenue (Metro Planning, 1990).

C.4.4 Applicability to Ontario

Ontario's population is expected to grow to 11.5 million people by 2005 from 9.1 million in 1988. The number of household will grow even more quickly. In addition, assuming a sixty year average life for residential buildings by 2005 about 4.7 million people, or 40 per cent of the population will be housed in new dwelling units build after 1988. Through a combination of "urban intensitification", including in-filling, and building 4–6 story residential buildings along major arteries, and greater use of planned urban communities, a saving in urban travel demand of 25 per cent for these new developments might be expected (10% overall).

Requiring all new development to occur within existing urban areas after 1995 might be expected to reduce transportation demand by about 15 per cent.

Appendix C.5 Traffic management measures

C.5.1 Introduction

The objective of traffic management initiatives is to improve the vehicle rate of speed and changes in speed at which the vehicle travels, and reduce the number and duration of vehicle stoppages. These traffic systems improvements result in fewer stop-and-go occurrences, reduced idling time for vehicles and a decrease in the amount of traffic congestion. The additional benefits which may arise include:

- decreased energy use; and
- decreased emissions.

However, a strategy of traffic improvement measures may not result in a fuel savings and emissions reduction. If the construction of new roadways is undertaken to improve a traffic congestion problem the result may be an increase in energy use and emissions due to increased vehicle traffic and a shift from public transit to motor vehicles. Therefore, caution must be taken when implementing traffic management measures in isolation as energy use can actually increase as driving becomes easier and more pleasant; increasing the number of cars on the road.[1] Thus, it becomes important for traffic management to be applied in an area-wide fashion to achieve the desired result. To reduce congestion, incentives or disincentives which encourage mode shifting to transit and other high occupancy vehicles are required in conjunction with traffic management measures.

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[1] Some authors have argued that fuel savings do **not** accrue from decreasing congestion and increasing vehicle speeds (See, Newman and Kenworthy, 1989.)

Incentives are used to alter vehicle operator's mode choice and promote the use of alternative transportation management systems. Applicable incentives include:

- priority at metered ramps;
- transit/HOV facilities (park and ride lots with easy access);
- transit fare and service integration;
- high transit profile (marketing); and
- tax credits for transit users.

Disincentives can also be used to shift people from autos to other modes of transportation:

- gas taxes
- parking taxes
- ownership taxes.

When traffic management measures are implemented within a transportation management plan improvements in traffic flow will occur over the long term and the potential energy saving and emission reduction benefits may be realised.

C.5.2 Potential traffic management measures

A list of potential traffic management measures is presented in Table C-31. The measures are more effective in developed urban areas, along major travel corridors and where the street conditions are suitable for utilizing traffic management measures. The cost (1988$) associated with potential traffic management measures is estimated as follows:

- Low cost: less than $50,000 per kilometre.
- Medium cost: $50,000 to $250,000 per kilometre.
- High cost: greater than $250,000 per kilometre.

In general, the implementation of traffic management measures is site specific. Improved traffic signal systems can be implemented on an area wide basis, systems and high occupancy vehicle lanes can be implemented on a corridor basis.

Table C-31
Potential energy savings due to improved traffic management

Measure	Potential decrease in energy use	Expected cost
Improved traffic signal systems	3.5% - 20%	Medium to high
Widening of intersections	20%	Low to medium
One-way street systems	5% - 25%	Low to medium
Replacement or removal of signs and signals	Decrease varies	Low
Improved signal timing	6%	Low
Flashing of signals	Decrease varies	Low
Freeway control	8% - 10%	High
Improved street signing	Small decrease	Low
Improved route identification	Small decrease	Low
Turning restrictions	4%	Low to medium
Reversible lanes	8% - 10%	Low
Bus bays	4%	Low to medium
Parking restrictions	1% - 3%	Low

Sources: Ontario Ministry of Transportation and Communications, 1982.
Yu, 1984.
Berkshire County Regional Planning Commission, 1982.
U.S. Department of Transportation, 1983.

C.5.3 Criteria and concerns

The selection of traffic management measures is based on a number of criteria

- level of urban density and development
- current traffic flow patterns and problems
- expected cost
- improvement in travel time
- planned development and land use
- effect on mode split
- effect on travel demand
- potential energy savings
- potential emissions reduction

C.5.4 Effectiveness in Ontario

The need for efficient transportation routes has grown along with the population and employment to the point now where congestion on the streets and highways is a public concern in major urban centres like the Greater Toronto Area (GTA). Congestion is widespread affecting not only freeways, but many municipal roads. This situation not only results in delays for commuters; it also has a negative impact on trucking and other commercial activity. Current congestion on provincial highways results in:

- speeds of 50 km/h or less for the peak hour;
- speeds of 55 km/h or less for the peak period; and
- decreased growth.

Although the GTA experiences the worst traffic congestion in Ontario, it is also the area which has incorporated several traffic management measures including:

- freeway traffic management systems (FTMS); and

- computerized traffic signal control systems.

Studies are presently being conducted within the GTA to establish potential transit and high occupancy vehicle lane corridors. The potential to establish energy use reduction and cost estimates of these area wide initiatives are presented on Table C-32.

Table C-32
Impact of traffic management measures on the Greater Toronto Area

Measure	Potential Energy Use Reduction in the GTA	Expected Cost
Improved traffic signal systems	3.5%	Medium to high
One-way street systems	5%–25%	Low to medium
Reversible lanes	8%–10%	Low
Turning restrictions	4%	Low

Source: Ontario Ministry of Transportation and Communication, 1981;1982.

Based on the regional trip analysis described in Section C.3 the Greater Toronto Area constitutes about 36 per cent of the province's automobile and light truck energy use. Improvements in the GTA would result in a provincial fuel savings from automobiles and light trucks of between 1 and 9 per cent on a provincial basis.

The potential for decreased energy use from traffic management measures in other areas of the province depends on the nature of the traffic problem, urban intensity, and the extent that traffic management measures have been implemented. It is expected that if major traffic management initiatives were adopted where appropriate in the Province, an energy savings of between 5 per cent and 10 per cent of urban energy use could be achieved by 2005. Such a saving corresponds to between 16 PJ/a and 36 PJ/a by 2005 (Table C-33).

C.5.5 Conclusion

Two levels of effectiveness of traffic management measures are considered in the analysis of energy use and emissions:

- low utilisation of traffic management measures resulting in a 5 per cent reduction in urban fuel consumption; and
- medium utilisation of traffic management measures resulting in a 10 per cent reduction in urban fuel consumption.

The increased use of traffic management measures through-out the Province is estimated to reduce fuel consumption by 16 to 36 PJ/a by 2005.

Table C-33
Potential reduction in energy use from traffic management measures in Ontario

Measure/Action	Potential energy savings (PJ/a)		
	1995	2000	2005
Urban traffic management - low estimate of reduction in urban Energy use	3	10	16
Urban traffic management - medium estimate of reduction in urban energy use	10	17	36

Appendix C.6 Inspection and maintenance programs

To help ensure compliance with emissions regulations, a number of jurisdictions require periodic inspections of automobiles. Among these jurisdictions are Switzerland, Sweden, West Germany, the Netherlands, and parts of the United States (OECD, 1988). As of 1987 inspection and maintenance (I/M) programs were operating in 59 urban areas in 31 states in the United States (Armstrong, 1987). The major purpose of the programs is to reduce the emissions from cars with excessive emissions due to engines being out of tune or defective emissions control equipment resulting from faulty components or tampering. Since a tune up and repairs that minimize emissions also provides most of the benefits of a complete tune up to minimize fuel consumption, I/M programs are also effective in lowering fuel consumption.

There are currently no I/M programs in operation in Canada. I/M programs are being considered by British Columbia for the greater Vancouver area, and by Ontario and Quebec for the Windsor-Quebec City corridor. Both areas experience some problems with ground level ozone, and the primary purpose of the I/M programs would be to reduce emissions of HC and NO_x, which are the precursors of ozone.

The potential gains in emissions and fuel consumption reductions that can be achieved through I/M programs depend on the type of program, the level of competence of the inspectors, level of enforcement and other factors. From a number of studies of pre-1980 motor vehicles (i.e. those without computer engine controls) it is evident that, on average, a fuel economy gain of four to five percent is likely for a sample of vehicles that fail emissions inspections (Harriott, 1980). Studies of newer cars, most of which have computer controls, found that after being repaired, the fuel economy of cars that did not pass I/M inspections improved by three to seven percent (Armstrong, 1987). As fewer than 50 percent of vehicles typically fail the I/M inspection the overall fleet fuel economy improvement associated with

the maintenance mandated by the I/M programs is about two to four percent. However, because drivers are aware of the requirements for vehicle testing, it is likely that tested automobiles are already better maintained—and therefore more likely to pass the inspection—than vehicles in jurisdictions without testing requirements. Consequently, improvements associated with the program as a whole may be considerably higher. One estimate of the energy savings associated with improved vehicle maintenance estimated these at fifteen percent (DPA, 1989:26).

The United States Environmental Protection Agency (EPA) has established a goal of 25 percent reduction in HC and CO by implementing I/M programs. However, the EPA goals are not achieved in most cases.

The California experience with its I/M program provides some useful insights into the emissions reductions that may be possible in Ontario through an I/M program. An evaluation of California's new I/M program, which was started in 1984, was published in 1987 (Sommerville, 1987). The California I/M program, called "Smog Check" requires passenger cars and light trucks to be inspected at licensed private stations once every two years and on change of registration. A comprehensive evaluation of the program determined that the program was reducing HC, CO and NO_x emissions by 12, 10, and 4 percent, respectively. (Fuel economy improvements were not considered in the evaluation.) The reductions were falling short of the EPA goals due to deficiencies in testing procedures, mechanic qualification requirements and enforcement practices.

Assuming that all of the deficiencies are corrected, the theoretical benefits of the Smog Check program are shown in the table below.

Table C-34
Theoretical benefits of improving the smog check program
(in percent)

	HC	CO	NO_x
Baseline benefits	12.3	9.8	3.9
Eliminate all tampering	+16.6	+10.7	+10.9
Repair non-tampering defects	+13.4	+5.2	+9.4
Total	42.3	25.7	24.2

Source: Sommerville, 1987.

C.6.1 Effectiveness in Ontario

Based upon the results of the studies of fuel economy improvements discussed above and the results of the evaluation of California's I/M program, estimates of the fuel consumption reductions from the passenger car and light truck fleet that could be achieved through an I/M program are conservatively estimated at five percent. In the absence of better information more specific to Ontario, it is assumed that the emission reductions presented in Table C-34 are applicable to Ontario.

C.6.2 Program costs

The major costs to a regulatory agency of an I/M program would be for operations and enforcement, and will vary depending on the types of tests performed and the frequency with which inspections are required. Nevertheless, costs can be expected to be quite modest. In Washington State, the 1982 cost of removal of one tonne of CO and hydrocarbon emissions was estimated at $140 (OECD, 1988). In Canada, costs have been estimated to be $16 per vehicle inspected per annum, with a cost of reducing NO_x and VOCs of 1225 $/t (VHB,1989:30).

Most or all of the program costs could be recovered through fees charged to vehicle owners. Apart from the I/M fee, the costs of carrying out any necessary repairs would also be borne by vehicle owners. The burden of repair costs typically falls on lower income people since they tend to drive older cars and cannot afford to keep them in as good repair as higher income people. In order to limit the costs to low income people some I/M programs have a limit on the cost of repairs. For example, California limits repair costs to $50. While this removes some of the burden on lower income people, it also limits the gains that are possible from an I/M program. Although most vehicles failing tests need only minor adjustments or replacement of inexpensive parts, the average repair cost to pass a retest in Washington State in 1982 was $48. The more stringent the I/M program, the greater will be the need for repairs to cars that fail the inspections. Unless the program includes free or subsidized repairs, lower income people will bear a disproportionate part of these costs.

Appendix C.7 Incentives for substituting communications for transportation

Much of the reason for transportation is to communicate. People travel to meet with other people, or to deliver documents. Rapid change in the electronics industry has lead to the development of technologies that can enable communications without transportation. This section considers technologies that enable communications to be substituted for transportation, and estimates potential energy savings.

C.7.1 Communications technology

Almost any communications technology provides a potential substitute for transportation. The best known is the most readily available: the telephone. Other technologies, or ways of using them can also decrease the need for transportation. Among these are:

- audio and video technologies for teleconferencing
- facsimile machines for transmitting documents
- computers and modems for exchanging data, or messages
- advanced telephone equipment.

Each of these technologies can reduce the demand for transportation, and the energy use and emissions associated with it.

Teleconferencing

Teleconferencing is defined as a means of linking three or more individuals in separate locations, electronically (Cukier,1985). There are a wide range of potential technologies, including conference calls, freeze-frame video, and full-motion video.

Video-conferences are becoming increasingly popular, and some are predicting that video-conferencing will change the shape of business in the 1990s the way the fax machine did in the 1980s (McArthur,1991). Among the factors contributing to the upsurge in interest in video-conferencing are the recession, and concerns about air safety in light of the Gulf War. However, this increase indicates that much business travel is non-essential and could be served through via other means.

For many meetings, teleconferencing is a cost-effective alternative to travel, particularly where involvement of a large number of people is required.

It is estimated that teleconferencing has the potential to reduce transportation energy use by two per cent (Cukier,1985).

Telecommuting

About 900 000 businesses are operated out of homes in Canada, though many of these use their homes merely as a base for activities such as fishing and sales. However, a rapidly growing component of home work is professional activity using advanced technologies. The widespread availability of fax machines and personal computers has eliminated or reduced the need for many workers to commute to work every day. For many workers in the service sector, working from home is an increasingly viable alternative to the daily commute.

As these technologies proliferate, working from home can be expected to increase. If by 2005 ten percent of the workforce telecommutes by 2005, energy savings can be expected to be about two percent of total energy use.

Advanced telephone technology

The telephone company has long based much of its advertising on its ability to economically replace travel. With advanced telephone technology, more and more services will be accessible from the home, including banking, entertainment and information services. However, the potential for these services to supplant energy use for transportation is likely to be quite small, in the order of one per cent of total energy use.

C.7.2 Measures to encourage communications instead of transportation

Many of the economic measures already discussed will make communications an increasingly attractive alternative to transportation. Other measures that can be taken include information and education programs, demonstration of potential benefits through continuing government use of teleconferencing, for example, and removal of regulatory barriers such as archaic zoning by-laws which disallow even compatible mixed land-uses, and service pricing on the basis of minimum connect times and voice-based bandwidths.

C.7.3 Potential energy savings

There are few published estimates of the potential transportation energy savings associated with communications technologies. However, with the proliferation of new technologies, at increasingly affordable costs, it is does not seen unreasonable to estimate that overall communications could replace one trip in twenty, or 5 per cent of all trips. Since communications is relatively insensitive to distance, it is not unreasonable to assume that if communications replaces 5 per cent of all trips, that it can displace 5 per cent of transportation energy use. This amount is used in the scenarios.

Appendix C.8 Restricting transportation demand

A further means by which emission reductions and energy savings can be brought about is through restricting the demand for transportation. This can be done in several ways, with varying degrees of effectiveness and affecting different transportation modes. These include:

- placing restrictions on *where* people can travel
- placing restrictions on *when* people can travel
- restricting *how much* people can travel (or at least how much fuel they can use to travel)

C.8.1 Geographic restrictions on travel

Numerous measures are available to reduce transportation in specific areas including traffic cells, parking restrictions, and high occupancy vehicle lanes.

Traffic cells

Several European cities, including Göteborg, Sweden; Bremen, West Germany; Besançon, France; Groningen, Netherlands have implemented traffic cells to restrict the use of automobiles within the city (Lowe, 1990). Drivers of personal automobiles are prohibited from crossing cell boundaries within the city core, though bicyclists, pedestrians, emergency and public transit vehicles may do so. In Göteborg, the first generation of cells reduced traffic flows across the borders by 45 per cent between 1970 and 1982, while significantly reducing casualties (OECD, 1988).

The use of traffic cells must be combined with other measures to promote alternative transportation modes. Without these, one might expect travel distances (and hence energy use and emissions) to increase.[1] Similarly, if not carefully integrated with other measures, there may be adverse effects on trade.

Parking restrictions

Restricting the availability of parking in selected locations may also be an effective means of reducing the demand for transportation, or precipitating a shift to a more energy efficient mode. For example, Geneva prohibits car parking at workplaces in the central city, and Paris is removing more than 100 000 street parking places in central Paris to make space for public transport and pedestrians (Lowe, 1990). Copenhagen has reduced traffic in its central core by prohibiting on-street parking, however specific measures of the extent of this reduction are not readily available.[2]

Provided there are alternatives available to taking automobiles to the destinations, parking restrictions can reduce traffic in some specific locations, and they need not have an adverse impact on commerce. However, they are only applicable where there is a strong drawing destination, probably only in urban areas with well developed transit systems.

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[1] In Göteberg, car drivers going in and around the cells had their travel distances increased by 7 per cent, though this seems to have been cancelled out by shorter trip times (OECD, 1988).

[2] Although not strictly a restriction on parking, by charging federal employees in the National Capital Commission market rates for pricing, the federal government brought about a 23 per cent reduction in employees driving to work (City of Vancouver, 1990).

High occupancy vehicle lanes

High Occupancy Vehicle Lanes (HOVS) have been found to be useful tools in reducing congestion and energy consumption in major urban centres worldwide.

Locations where successful implementation has occurred in North America include:

- Los Angeles
- Houston
- San Francisco
- Minneapolis

These jurisdictions have generally been very successful in increasing ride-sharing, optimizing use of highway facilities and generating public support. The two areas of greatest potential for HOV lane application in Ontario are Provincial freeway networks in the Ottawa-Carleton Region and the GTA, as they represent areas with high volume congested urban corridors. A major factor affecting HOV concepts in the urban area is the combined effect of changing land use patterns, city core suburb relations, employment distribution and competition with transit initiatives.

With suburban employment increasing, the suburb-to-suburb work trip has brought congestion to the suburbs as well as demands that are not related to the CBD-oriented trip. HOV's provide a possible solution to the movement of persons in specific corridors that serve both the suburban and CBD oriented trips provided they are planned and operated in conjunction with other strategies that increase load factors, e.g. park and ride, park and pool, ride-matching employer incentives, van pools, etc.

Effectiveness

A measure of how effective an HOV lane is public perception. Public acceptance depends on it being perceived as an effective use of a highway corridor. If too few vehicles use the facility, demands for conversion to mixed flow use and high violation rates will result. A throughput minimum of 600 to 900 v.p.h. in the peak hour is considered acceptable in most cities on an HOV lane.

Prior to implementing an HOV system, an HOV-suitable corridor must be congested for a significant period on a recurring daily basis, since the incentive to switch to HOV is apparent only in comparison to a slower mixed-flow trip. Based on experience HOV's are beneficial only when there is at least a 6-10 minute travel time saving. The type of facility chosen must also be corridor-specific as a generic type plan would most likely result as ineffective or may experience worse congestion.

Typically, most home to work trips use more than one corridor, therefore, the incentive to use an HOV lane may be significantly reduced if benefits to the user only occur on one leg of the trip. It becomes important then to recognize the possible need for HOV's and their facilities on a network-wide basis as well as complemented with other measures, such as:

- preferential treatment at metered ramps; and
- easy access to park and ride facilities

Energy savings potential

The most dramatic effects of energy saving with respect to HOV's will be experienced in a specific corridor. Studies have shown that site-specific fuel consumption could be as high as 5%. However, reports from several individual projects across the U.S. found a reduction in fuel consumption of approximately 3%. It should be recognized that the benefits resulting from HOV implementation mostly come from the areas of travel time saving and increased person throughput with less vehicles. Additional benefits would include lower vehicle operating costs and a *potential* lowering of energy consumption. An example of potential energy savings with the implementation of HOV lanes for two (2) specific corridors are shown on Table C-35.

Marketing of HOVs

The key to ensure public and political acceptance is through aggressive marketing and education with commitment to success. Experience has shown that an HOV lane will fail if there is not a sustained broad-based commitment from the agencies involved, such as:

- Provincial highway authority
- local municipalities
- enforcement agencies
- transit authorities
- taxi companies
- major employers
- developers

Table C-35
Example of potential energy savings from HOVs within two specific corridors.

Corridor	Hwy.401	Hwy.403
Location	Hwy.401 - White's Rd.to Milton East Lights	Hwy.403 - Hwy.410 & Hwy.401 to Q.E.W./Ford Dr.
Length	92 km	21.5 km
Total Length of HOV Lane	15 km	21.5 km
Affected Length	16% of Total	100% of Total
Fuel consumption within corridor in 2006	1 417 000 000 L	183 000 000 L
Fuel consumption within affected length	226 720 000 L	183 000 000 L
Possible fuel reduction with HOV implementation	5%	5%
Fuel consumption reduction potential within corridor in 2006	11 336 000 L	9 150 000 L

This is important as a significant portion of benefits to another user related not only to the HOV lane itself but from the convenience of a park and ride facility, a van pool organized by an employer, reliable transit back-up, etc. In the short term, however, there must be a significant marketing and public information effort to identify these benefits and outline incentives to the potential HOV user.

Unlike a mixed flow freeway lane, the ability of an HOV lane to achieve its goal depends on behaviourial and attitudinal changes in commuters, thus maximizing the chances of the program's success.

C.8.2 Restricting *when* one can travel

There are several reasons why restrictions might be placed on when one can travel by a particular transport mode or on a particular route, including to reduce peak congestion. To alleviate air pollution and traffic congestion, Athens introduced an emergency traffic management scheme in 1981 which limits automobiles in the central core during business hours on weekdays according to licence plate numbers, alternating between even and odd. Traffic within the affected area is estimated to be reduced by 20 per cent, based on limited monitoring (OECD, 1988).

C.8.3 Restrictions on *how much* one can travel

More correctly, this category of restrictions is on how much fuel one can use, or on what quantity of emissions can be released, i.e. rationing. Some analysts have argued that setting up a micro-market for allocating petroleum supplies (or alternatively carbon emissions) has a number of benefits over adjusting demand through price mechanisms (Carter, 1978). Among these benefits are:

- whereas gasoline demand is relatively price inelastic, and market responses can only be estimated, the effects on energy use and emissions of a well-designed rationing program can be precisely specified and targets can be met with confidence.

- rationing would be an effective educational tool about the seriousness of the global warming problem.

- rationing can be more equitable than carbon taxes, if equity is carefully considered in the design of the program—price increase (e.g. carbon taxes) favour the affluent at the expense of the poor.

However, rationing is widely thought of as a measure of last resort, suitable for use only in the most severe of emergencies.

Appendix D Detailed table of economic measures for the reduction of energy use and emissions in Ontario's transportation sector

Table D.1 Economic measures for the reduction of energy use and emissions in Ontario's transportation sector

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					Number:	1					2					
					Measure:	Carbon Tax (Stable CO2 Emissions By 2000)					Carbon Tax (20% Reduction In CO2 Emissions by 2005)					
					Instrument:	Economic					Economic					
					Effect:	Improve Vehicle Efficiency					Improve Vehicle Efficiency					
					Type of Action:	More Efficient Vehicles (Improve Vehicle Fuel Consumption 18%)					More Efficient Vehicles (Improve Vehicle Fuel Consumption 36%)					
						Year					Year					
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel		1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
5	Inter-city	Public	Extra-air	Turbo		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
6	Inter-city	Private	Auto	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
7	Inter-city	Private	Auto	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
8	Inter-city	Private	Light truck	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
9	Inter-city	Private	Light truck	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
10	Inter-city	General freight	Truck	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
11	Inter-city	General freight	Truck	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
12	Inter-city	General freight	Rail	Diesel		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
14	Inter-city	General freight	Marine	Heavy FO		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
15	Inter-city	General freight	Marine	Light FO		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
16	Inter-city	General freight	Marine	Kerosene		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
17	Inter-city	General freight	Marine	Coal		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
18	Inter-city	Specific freight	Rail	Diesel		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
20	Inter-city	Specific freight	Marine	Heavy FO		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
21	Inter-city	Specific freight	Marine	Light FO		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
22	Inter-city	Specific freight	Marine	Kerosene		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
23	Inter-city	Specific freight	Marine	Coal		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
24	Urban	Public	Streetcar&Subway	Electricity		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
30	Urban	Private passenger	Auto	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
31	Urban	Private passenger	Light truck	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
32	Urban	Private passenger	Light truck	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
33	Urban	Non-freight	Truck	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
34	Urban	Non-freight	Truck	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
35	Urban	Freight	Truck	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
36	Urban	Freight	Truck	Diesel		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
37	Aviation	General	Airplane	Turbo		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
38	Aviation	General	Airplane	Aviation gas		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
39	Aviation	Government	Airplane	Turbo		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
40	Aviation	Government	Airplane	Aviation gas		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
41	Other	Private	Motorcycle	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
42	Other	Other	School bus	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62
43	Other	Private	Leisure vehicle	Gasoline		1.00	1.00	0.92	0.82	0.82	1.00	1.00	0.90	0.77	0.62

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					3					4				
					Gas Guzzler Tax					Gas Guzzler Tax				
					Economic					Economic				
					Improve Vehicle Efficiency					Improve Vehicle Efficiency				
					More Efficient Vehicles					More Efficient Vehicles				
					(Improve Passenger Vehicle Fuel Consumption 20%)					(Improve Passenger Vehicle Fuel Consumption 26%)				
					(Improve Truck Fuel Consumption 10%)					(Improve Truck Fuel Consumption 13%)				
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					5					6				
					Gas Guzzler Tax					Subsidies And Incentives For Public Transit				
					Economic					Economic				
					Improve Vehicle Efficiency					Reduce Travel Demand				
					More Efficient Vehicles					Transit Modal Split - 13.5%				
					(Improve Passenger Vehicle Fuel Consumption 32%)					(Reduce Urban Passenger Vehicle Travel Demand 5%)				
					(Improve Truck Fuel Consumption 14%)									
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	0.99	0.98	0.95
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	0.99	0.98	0.95
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	0.99	0.98	0.95
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	0.99	0.98	0.95
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					7					8				
					Subsidies And Incentives For Public Transit					Subsidies And Incentives For Public Transit				
					Economic					Economic				
					Reduce Travel Demand					Reduce Travel Demand				
					Transit Modal Split - 16.5%					Transit Modal Split - 22%				
					(Reduce Urban Passenger Vehicle Travel Demand 8%)					(Reduce Urban Passenger Vehicle Travel Demand 14%)				
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	Inter-city	Private	Auto	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.98	0.96	0.92	1.00	1.00	0.97	0.94	0.86
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.98	0.96	0.92	1.00	1.00	0.97	0.94	0.86
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.98	0.96	0.92	1.00	1.00	0.97	0.94	0.86
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.98	0.96	0.92	1.00	1.00	0.97	0.94	0.86
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					9					10				
					Carbon Tax					Carbon Tax				
					Economic					Economic				
					Reduce Travel Demand					Reduce Travel Demand				
					Reduce Passenger Vehicle Travel (Reduce Passenger Vehicle Travel Demand 3%)					Reduce Passenger Vehicle Travel (Reduce Passenger Vehicle Travel Demand 5%)				
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.99	0.98	0.95
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					11					12				
					Carbon Tax					Incentives For Communications Use				
					Economic					Economic				
					Reduce Travel Demand					Reduce Travel Demand				
					Reduce Passenger Vehicle Travel					Communications Instead of Transportation				
					(Reduce Passenger Vehicle Travel Demand 10%)					(Reduce Passenger Vehicle Travel Demand 5%)				
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.96	0.90
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.98	0.95	0.90	1.00	1.00	0.98	0.96	0.95
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

Number:					13					14						
Measure:					Set Cafe Standards					Set Cafe Standards						
Instrument:					Regulatory					Regulatory						
Effect:					Improve Vehicle Efficiency					Improve Vehicle Efficiency						
Type of Action:					More Efficient Vehicles (Improve Passenger Vehicle Fuel Consumption 20%) (Improve Truck Fuel Consumption 10%)					More Efficient Vehicles (Improve Passenger Vehicle Fuel Consumption 26%) (Improve Truck Fuel Consumption 13%)						
					Year					Year						
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005		
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87		
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87		
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.97	0.84	0.80	1.00	1.00	0.96	0.80	0.74		
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87		
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87		
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87		
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.90	1.00	1.00	0.98	0.90	0.87		
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					15					16				
					Set Cafe Standards					Increase Urban Density Levels				
					Regulatory					Regulatory				
					Improve Vehicle Efficiency					Reduce Travel Demand				
					More Efficient Vehicles					Better Land-Use Management				
					(Improve Passenger Vehicle Fuel Consumption 32%)					(Reduce Urban Vehicle Travel Demand 10%)				
					(Improve Truck Fuel Consumption 14%)									
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	1.00	1.00
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.90
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.90
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	0.98	0.90
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	0.98	0.90
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	0.98	0.90
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.95	0.75	0.68	1.00	1.00	1.00	0.98	0.90
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	0.98	0.90
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	0.98	0.90
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	0.98	0.90
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.98	0.88	0.86	1.00	1.00	1.00	0.98	0.90
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					17					18				
					Increase Urban Density Levels					Improve Control Of Traffic Flows				
					Regulatory					Regulatory				
					Reduce Travel Demand					Improve Vehicle Efficiency				
					Better Land-Use Management					Improve Urban Traffic Management				
					(Reduce Urban Vehicle Travel Demand 15%)					(Improve Urban Vehicle Fuel Consumption 5%)				
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	Inter-city	Private	Auto	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.99	0.97	0.95
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

					19 Improve Control Of Traffic Flows Regulatory Improve Vehicle Efficiency Improve Urban Traffic Management (Improve Urban Vehicle Fuel Consumption 10%)					20 Require Regular Inspection And Maintenance Regulatory Improve Vehicle Efficiency Passenger Vehicle Maintenance (Improve Vehicle Fuel Consumption 5%)				
					Year					Year				
Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
7	Inter-city	Private	Auto	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	0.97	0.95	0.90	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.97	0.95	0.90	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.97	0.95	0.90	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.97	0.95	0.90	1.00	1.00	0.99	0.97	0.95
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table D.1
Economic Measures for the Reduction of Energy Use and Emissions in Ontario's Transportation Sector

Restrict Passenger Vehicle Use
Regulatory
Reduce Travel Demand
Limits on Passenger Vehicle Travel
(Reduce Vehicle Travel Demand 5%)

Number	Spatial Area	Type of Vehicle	Transportation Mode	Type of Fuel	Year 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.97	0.95
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.97	0.95
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.97	0.95
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.97	0.95
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.99	0.97	0.95
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.99	0.97	0.95
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.99	0.97	0.95
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.99	0.97	0.95
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.99	0.97	0.95
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.99	0.97	0.95
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00

Appendix E Detailed results tables

Appendix E.1 Scenario 1: Actions economically attractive to society in their own right by 2005

E.1.1 Strategy 1: Economic instruments

Measures applied:

- Subsidies/incentives for public transit - low
  → increase transit mode split to 13 per cent
  → reduce urban passenger vehicle travel 5 per cent
- Incentives for communications use
  → reduce passenger vehicle travel 5 per cent

Table E.1.1

Scenario 1: Actions Economically Attractive to Society

Strategy 1: Economic Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS					CHANGE IN EFFICIENCY COEFFICIENTS				
					I.					II.				
					Vehicle Demand					Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.90	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.97	0.94	0.90	1.00	1.00	1.00	1.00	1.00
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.97	0.94	0.90	1.00	1.00	1.00	1.00	1.00
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.97	0.94	0.90	1.00	1.00	1.00	1.00	1.00
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.97	0.94	0.90	1.00	1.00	1.00	1.00	1.00
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.1.1

Scenario 1: Actions Economically Attractive to Society

Strategy 1: Economic Instruments

						CHANGE IN TRANSPORTATION DEMAND						CHANGE IN EFFICIENCY					
								C'	(I'C)					D'	(II'D)		
						Revised Vehicle Demand						Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.69E+09	1.80E+09	1.96E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.70E+09	1.81E+09	1.97E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.20E+08	1.28E+08	1.40E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	4.95E+09	5.28E+09	5.75E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.74E+06	6.02E+06	6.79E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.71E+10	3.89E+10	4.19E+10	MJ/pass.km	3.09E+00	3.01E+00	2.94E+00	2.77E+00	2.66E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.88E+09	3.41E+09	4.93E+09	MJ/pass.km	1.30E+00	1.22E+00	1.13E+00	1.09E+00	1.07E+00
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.61E+09	5.19E+09	5.91E+09	MJ/pass.km	5.85E+00	5.74E+00	5.41E+00	5.09E+00	4.80E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.94E+08	2.18E+08	2.48E+08	MJ/pass.km	5.08E+00	4.93E+00	4.64E+00	4.37E+00	4.12E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.77E+00	4.65E+00	4.53E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.59E+00	1.52E+00	1.44E+00
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a						MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a						MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a						MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a						MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a						MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a						MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.45E-01	4.41E-01	4.36E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.83E+07	1.94E+07	2.10E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.39E+09	3.59E+09	3.89E+09	MJ/pass.km	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.88E+06	4.14E+06	4.25E+06	MJ/pass.km	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.96E+06	1.25E+07	2.35E+07	MJ/pass.km	5.92E-01	3.28E+00	1.56E+00	1.94E+00	2.01E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.07E+09	1.91E+09	2.67E+09	MJ/pass.km	3.96E+00	3.74E+00	3.43E+00	3.29E+00	3.23E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.94E+10	5.10E+10	5.27E+10	MJ/pass.km	4.58E+00	4.50E+00	4.43E+00	4.16E+00	4.00E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.39E+09	4.89E+09	5.40E+09	MJ/pass.km	5.83E+00	5.74E+00	5.41E+00	5.09E+00	4.80E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.84E+08	2.05E+08	2.26E+08	MJ/pass.km	5.01E+00	4.93E+00	4.64E+00	4.37E+00	4.12E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	MJ/pass.km	7.24E+00	7.13E+00	6.78E+00	6.61E+00	6.45E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	MJ/pass.km	5.66E+00	5.57E+00	5.43E+00	5.17E+00	4.91E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.92E+00	3.83E+00	3.73E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	9.85E+00	9.38E+00	8.90E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
40	Aviation	Government	Airplane	Aviation gas	pass.km/a						MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
	TOTAL															

Table E.1.1

Scenario 1: Actions Economically Attractive to Society

Strategy 1: Economic Instruments

REVISED ENERGY USE — E' (C''D')

SCENARIO EMISSIONS

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (MegaJoules) 1988	1990	1995	2000	2005			Strategy Tonnes of CO2 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.93E+09	3.12E+09	3.40E+09		tonnes	180 342	187 375	206 898	220 377	240 093
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.48E+09	1.57E+09	1.72E+09		tonnes	94 572	94 612	104 473	111 283	121 233
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.96E+07	9.99E+07	1.10E+08	1.17E+08	1.28E+08		tonnes	6 787	6 790	7 497	7 986	8 700
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.27E+10	2.42E+10	2.64E+10		tonnes	1 403 880	1 458 577	1 610 547	1 715 539	1 868 940
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.66E+10	3.84E+10	4.34E+10		tonnes	2 232 781	2 267 014	2 593 629	2 721 252	3 072 163
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.09E+11	1.08E+11	1.11E+11	6	tonnes	6 683 943	6 960 600	7 420 924	7 315 156	7 574 751
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	2.12E+09	3.71E+09	5.30E+09		tonnes	48 290	67 438	149 551	262 057	374 285
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.49E+10	2.64E+10	2.84E+10		tonnes	1 584 182	1 599 428	1 695 568	1 795 459	1 928 820
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	9.00E+08	9.52E+08	1.02E+09		tonnes	57 983	60 037	63 648	67 306	72 085
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.43E+10	5.07E+10	5.66E+10		tonnes	2 793 483	2 820 366	3 007 966	3 443 815	3 848 093
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.75E+10	5.73E+10	6.25E+10	11	tonnes	2 825 701	2 925 785	3 356 961	4 050 227	4 419 731
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 164	388 828	454 124	519 900
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454
15	Inter-city	General freight	Marine	Light FO	MJ/a							tonnes					
16	Inter-city	General freight	Marine	Kerosene	MJ/a						16	tonnes					
17	Inter-city	General freight	Marine	Coal	MJ/a							tonnes					
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 080	503 513
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 868	554 396	626 499	651 106	684 243
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	MJ/a						21	tonnes					
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a							tonnes					
23	Inter-city	Specific freight	Marine	Coal	MJ/a							tonnes					
24	Urban	Public	Streetcar&Subway	Electridty	MJ/a	1.22E+09	1.26E+09	1.40E+09	1.50E+09	1.63E+09		tonnes					
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.04E+09	1.06E+09	1.10E+09		tonnes	68 125	69 660	73 445	74 953	77 989
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.14E+09	7.58E+09	8.21E+09	26	tonnes	443 056	460 243	504 790	535 902	580 129
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.63E+06	9.21E+06	9.48E+06		tonnes	511	532	587	626	644
28	Urban	Private passenger	Auto	Electridty	MJ/a	8.70E+05	1.08E+06	6.19E+06	2.42E+07	4.73E+07		tonnes					
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.66E+09	6.30E+09	8.64E+09		tonnes	83 829	118 817	258 464	445 537	610 543
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	2.19E+11	2.12E+11	2.11E+11		tonnes	13 241 454	14 118 327	14 864 897	14 427 236	14 318 410
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.37E+10	2.49E+10	2.59E+10	31	tonnes	1 493 131	1 536 705	1 612 784	1 690 548	1 760 521
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	8.57E+08	8.97E+08	9.31E+08		tonnes	46 205	57 682	60 540	63 374	65 796
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.52E+10	3.47E+10	3.25E+10		tonnes	2 363 984	2 424 810	2 394 365	2 361 485	2 208 632
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.92E+09	3.69E+09	4.14E+09		tonnes	105 714	130 850	206 047	261 022	292 643
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.24E+10	1.12E+10	9.51E+09		tonnes	878 445	884 666	842 217	760 830	646 244
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.78E+10	3.16E+10	3.45E+10	36	tonnes	1 717 010	1 775 824	1 966 817	2 234 458	2 436 450
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 498	95 000	102 338	115 173
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 162	167 146	192 469	207 351	233 355
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09		tonnes	363 667	372 563	428 995	462 166	520 114
40	Aviation	Government	Airplane	Aviation gas	MJ/a							tonnes					
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 308	74 106
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 408	96 592	94 580	92 609	90 685
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811
	TOTAL					6.15E+11	6.41E+11	6.90E+11	7.20E+11	7.56E+11			42 281 126	44 033 769	47 472 139	49 543 465	52 064 329
					RELATIVE TO 1988 ENERGY USE			112.2%	117.0%	122.9%		RELATIVE TO 1988 EMISSIONS			112.3%	117.2%	123.1%

Table E.1.1

Scenario 1: Actions Economically Attractive to Society

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005	Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	334	356	388	tonnes	3 668	3 811	4 208	4 482	4 883
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	676	720	785	tonnes	5 436	4 502	3 657	2 495	2 561
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	49	52	56	tonnes	916	830	831	793	851
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	79	84	91	tonnes	669	695	768	818	891
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	127	133	150	tonnes	1 064	1 081	1 236	1 297	1 464
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 373	2 339	2 422	tonnes	62 626	42 841	35 065	24 514	25 111
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	315	552	789	tonnes	676	889	1 904	3 038	4 440
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	542	574	617	tonnes	8 717	6 069	5 536	4 775	5 083
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	134	142	152	tonnes	208	197	197	194	223
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	962	1 101	1 231	tonnes	1 099	1 026	1 053	1 108	1 251
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	7 075	8 536	9 314	tonnes	52 850	46 690	43 595	35 429	38 307
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280	tonnes	21 125	21 078	23 694	26 278	28 676
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 538	tonnes	3 132	3 370	4 409	5 149	5 895
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307	tonnes	651	619	576	690	810
15	Inter-city	General freight	Marine	Light FO	tonnes						tonnes					
16	Inter-city	General freight	Marine	Kerosene	tonnes						tonnes					
17	Inter-city	General freight	Marine	Coal	tonnes						tonnes					
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814	tonnes	8 070	8 183	8 618	9 539	10 240
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025	tonnes	5 895	6 286	7 104	7 383	7 758
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes						tonnes					
22	Inter-city	Specific freight	Marine	Kerosene	tonnes						tonnes					
23	Inter-city	Specific freight	Marine	Coal	tonnes						tonnes					
24	Urban	Public	Streetcar&Subway	Electricity	tonnes						tonnes					
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	119	121	126	tonnes	1 385	1 417	1 494	1 524	1 586
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 267	3 468	3 754	tonnes	10 489	9 019	7 277	4 949	5 048
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4	tonnes	28	27	27	26	26
28	Urban	Private passenger	Auto	Electricity	tonnes						tonnes					
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	545	939	1 287	tonnes	387	512	1 061	1 703	2 404
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 754	4 614	4 579	tonnes	83 703	58 114	46 677	32 116	31 612
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	516	541	563	tonnes	8 253	5 831	5 266	4 496	4 640
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	128	134	139	tonnes	168	189	187	183	203
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	786	755	706	tonnes	14 065	10 003	9 348	8 410	7 605
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	434	550	617	tonnes	341	379	545	636	759
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	269	243	207	tonnes	426	395	358	297	255
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	4 145	4 709	5 135	tonnes	5 666	4 944	4 130	3 158	3 419
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6	tonnes	38	39	45	49	55
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11	tonnes	73	74	86	92	104
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25	tonnes	173	178	204	220	248
40	Aviation	Government	Airplane	Aviation gas	tonnes						tonnes					
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53	tonnes	770	520	458	359	401
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30	tonnes	668	601	533	468	451
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203	tonnes	3 160	2 297	2 420	2 518	2 782
	TOTAL					32 842	33 889	37 212	41 592	45 403		306 597	242 704	222 586	189 185	200 042

Table E.1.1

Scenario 1: Actions Economically Attractive to Society

SCENARIO EMISSIONS

SCENARIO EMISSIONS

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005	Units	Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	204	218	237	tonnes	198	206	227	242	263
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	430	415	443	tonnes	292	292	322	343	374
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	597	527	554	tonnes	136	136	150	160	174
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	878	935	1 019	tonnes	56	58	64	68	74
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0	tonnes	89	90	103	108	122
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	51 206	40 079	41 434	tonnes	10 809	11 560	12 616	13 230	14 230
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	600	1 024	1 529	tonnes	236	351	844	1 536	2 220
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 865	6 539	7 034	tonnes	1 353	1 394	1 568	1 765	2 010
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	62	65	77	tonnes	73	78	87	98	111
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814	tonnes	163	168	190	224	256
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626	tonnes	2 835	3 025	3 840	4 872	5 591
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393	tonnes	1 140	1 137	1 278	1 418	1 547
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344	tonnes	182	196	256	299	342
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70	tonnes	179	170	158	189	222
15	Inter-city	General freight	Marine	Light FO	tonnes						tonnes					
16	Inter-city	General freight	Marine	Kerosene	tonnes						tonnes					
17	Inter-city	General freight	Marine	Coal	tonnes						tonnes					
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497	tonnes	435	442	465	515	553
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769	tonnes	342	365	412	429	450
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes						tonnes					
22	Inter-city	Specific freight	Marine	Kerosene	tonnes						tonnes					
23	Inter-city	Specific freight	Marine	Coal	tonnes						tonnes					
24	Urban	Public	Streetcar&Subway	Electricity	tonnes						tonnes					
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	73	74	77	tonnes	75	76	81	82	86
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	855	823	873	tonnes	563	584	641	681	737
27	Urban	Public	Bus	Gasoline	tonnes	34	20	19	17	17	tonnes	4	4	5	5	5
28	Urban	Private passenger	Auto	Electricity	tonnes						tonnes					
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	341	574	828	tonnes	135	202	479	861	1 202
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	68 164	52 508	52 159	tonnes	14 446	15 681	16 794	17 333	17 913
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 481	6 157	6 420	tonnes	1 281	1 339	1 492	1 661	1 834
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	59	62	70	tonnes	59	75	83	92	102
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 711	6 885	6 245	tonnes	1 632	1 700	1 766	1 787	1 712
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	172	214	262	tonnes	119	150	242	321	380
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166	tonnes	63	65	65	60	52
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591	tonnes	304	320	364	434	499
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63	tonnes	3	3	4	4	5
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119	tonnes	6	6	7	8	9
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284	tonnes	14	15	17	18	21
40	Aviation	Government	Airplane	Aviation gas	tonnes						tonnes					
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661	tonnes	133	142	166	194	227
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293	tonnes	99	98	96	94	92
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284	tonnes	367	391	457	535	626
	TOTAL					241 480	190 347	168 899	132 502	136 253		37 820	40 520	45 341	49 667	54 042

Table E.1.1 SCENARIO EMISSIONS

Scenario 1: Actions Economically Attractive to Society

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 682	1 792	1 952
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 199	2 207	2 386
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 827	4 198	4 192
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 453	2 613	2 847
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	3 951	4 145	4 680
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	374 397	298 063	313 055
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 445	2 526	3 750
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	65 530	57 243	62 242
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	149	161	188
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 506
14	Inter-city	General freight	Marine	Heavy FO	tonnes					
15	Inter-city	General freight	Marine	Light FO	tonnes					
16	Inter-city	General freight	Marine	Kerosene	tonnes					
17	Inter-city	General freight	Marine	Coal	tonnes					
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	3 023	3 141	3 301
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes					
21	Inter-city	Specific freight	Marine	Light FO	tonnes					
22	Inter-city	Specific freight	Marine	Kerosene	tonnes					
23	Inter-city	Specific freight	Marine	Coal	tonnes					
24	Urban	Public	Streetcar&Subway	Electricity	tonnes					
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	597	609	634
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 376	4 377	4 702
27	Urban	Public	Bus	Gasoline	tonnes	379	226	188	136	128
28	Urban	Private passenger	Auto	Electricity	tonnes					
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	820	1 416	2 030
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	498 384	390 493	394 092
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	66 470	62 330	53 898	56 811
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	142	152	172
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	79 771	62 652	57 312
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	414	529	641
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792
40	Aviation	Government	Airplane	Aviation gas	tonnes					
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 738	2 475	2 222
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	18 761	20 965
	TOTAL					1 895 797	1 344 440	1 191 456	975 197	1 008 949

E.1.2 Strategy 2: Regulatory instruments

Measures applied:

•	New CAFE standards — low	→ reduce passenger vehicle fuel consumption 20 per cent → reduce truck fuel consumption 10 per cent
•	Urban traffic management — low	→ reduce urban fuel consumption 5 per cent
•	Inspection and maintenance programs	→ reduce passenger vehicle fuel consumption 5 per cent

Table E.1.2

Scenario 1: Actions Economically Attractive to Society

Strategy 2: Regulatory Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS					CHANGE IN EFFICIENCY COEFFICIENTS				
					I.					II.				
					Vehicle Demand					Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.81	0.76
7	Inter-city	Private	Auto	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.81	0.76
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.81	0.76
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.81	0.76
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.89	0.86
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.89	0.86
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.79	0.72
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.79	0.72
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.79	0.72
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.79	0.72
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.1.2

Scenario 1: Actions Economically Attractive to Society

Strategy 2: Regulatory Instruments

CHANGE IN TRANSPORTATION DEMAND — C' (ΓC)

CHANGE IN EFFICIENCY — D' (Π'D)

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Revised Vehicle Demand 1988	1990	1995	2000	2005		Revised Vehicle Efficiency 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.79E+10	4.05E+10	4.41E+10	MJ/pass.km	3.09E+00	3.01E+00	2.83E+00	2.25E+00	2.02E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.91E+09	3.56E+09	5.19E+09	MJ/pass.km	1.30E+00	1.22E+00	1.08E+00	8.85E-01	8.16E-01
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.71E+09	5.41E+09	6.22E+09	MJ/pass.km	5.85E+00	5.74E+00	5.19E+00	4.15E+00	3.65E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.98E+08	2.27E+08	2.61E+08	MJ/pass.km	5.08E+00	4.93E+00	4.46E+00	3.56E+00	3.13E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.62E+00	4.15E+00	3.88E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.55E+00	1.35E+00	1.23E+00
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.40E-01	4.27E-01	4.14E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.74E+09	4.10E+09	MJ/pass.km	2.11E+00	2.11E+00	2.09E+00	2.05E+00	2.00E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.31E+06	4.73E+06	MJ/pass.km	2.23E+00	2.23E+00	2.21E+00	2.16E+00	2.12E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.96E+06	1.25E+07	2.35E+07	MJ/pass.km	5.92E-01	3.28E+00	1.55E+00	1.88E+00	1.91E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.10E+09	2.03E+09	2.96E+09	MJ/pass.km	3.96E+00	3.74E+00	3.26E+00	2.60E+00	2.33E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	5.09E+10	5.42E+10	5.84E+10	MJ/pass.km	4.58E+00	4.50E+00	4.21E+00	3.29E+00	2.89E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.52E+09	5.19E+09	5.98E+09	MJ/pass.km	5.83E+00	5.74E+00	5.14E+00	4.02E+00	3.47E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.90E+08	2.18E+08	2.50E+08	MJ/pass.km	5.01E+00	4.93E+00	4.41E+00	3.45E+00	2.97E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	MJ/pass.km	7.24E+00	7.13E+00	6.51E+00	5.72E+00	5.24E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	MJ/pass.km	5.66E+00	5.57E+00	5.21E+00	4.48E+00	3.99E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.77E+00	3.31E+00	3.03E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	9.46E+00	8.12E+00	7.23E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
	TOTAL															

Table E.1.2

Scenario 1: Actions Economically Attractive to Society

REVISED ENERGY USE — SCENARIO EMISSIONS

E' (C"D')

Strategy 2: Regulatory Instruments

Strategy

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (MegaJoules) 1988	1990	1995	2000	2005			Strategy Tonnes of CO2 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09		tonnes	180 342	187 375	211 120	229 560	252 729	
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09		tonnes	94 572	94 612	106 605	115 920	127 614	
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08		tonnes	6 787	6 790	7 650	8 319	9 158	
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.32E+10	2.52E+10	2.78E+10		tonnes	1 403 880	1 458 577	1 643 415	1 787 019	1 967 305	
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.74E+10	4.00E+10	4.57E+10		tonnes	2 232 781	2 267 014	2 646 560	2 834 638	3 233 856	
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.07E+11	9.13E+10	8.91E+10	6	tonnes	6 683 943	6 960 600	7 271 748	6 208 738	6 059 801	
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	2.07E+09	3.15E+09	4.24E+09		tonnes	46 290	67 438	146 545	222 421	299 428	
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.44E+10	2.24E+10	2.27E+10		tonnes	1 584 182	1 599 428	1 661 484	1 523 896	1 543 056	
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.82E+08	8.08E+08	8.16E+08		tonnes	57 983	60 037	62 368	57 126	57 668	
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.29E+10	4.52E+10	4.84E+10		tonnes	2 793 483	2 820 366	2 918 329	3 073 260	3 290 119	
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.61E+10	5.11E+10	5.35E+10	11	tonnes	2 825 701	2 925 785	3 256 923	3 614 423	3 778 870	
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 184	388 828	454 124	519 900	
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454	
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 080	503 513	
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 888	554 396	626 499	651 108	684 243	
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.39E+09	1.46E+09	1.55E+09		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09		tonnes	68 125	69 660	74 944	78 076	82 094	
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.21E+09	7.66E+09	8.21E+09	26	tonnes	443 056	460 243	509 941	541 484	580 129	
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.72E+06	9.31E+06	1.00E+07		tonnes	511	532	593	633	680	
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.13E+06	2.34E+07	4.49E+07		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.58E+09	5.30E+09	6.91E+09		tonnes	83 829	118 817	253 268	374 291	486 435	
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	2.14E+11	1.78E+11	1.69E+11		tonnes	13 241 454	14 118 327	14 566 082	12 120 166	11 454 728	
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.32E+10	2.09E+10	2.07E+10	31	tonnes	1 493 131	1 536 705	1 580 364	1 420 211	1 408 417	
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	8.39E+08	7.53E+08	7.45E+08		tonnes	46 205	57 682	59 323	53 240	52 637	
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.38E+10	3.01E+10	2.64E+10		tonnes	2 363 984	2 424 810	2 299 783	2 044 167	1 793 962	
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.80E+09	3.20E+09	3.36E+09		tonnes	105 714	130 850	197 908	225 948	237 699	
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.19E+10	9.69E+09	7.72E+09		tonnes	878 445	884 666	808 947	658 596	524 911	
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.67E+10	2.74E+10	2.80E+10	36	tonnes	1 717 010	1 775 824	1 889 124	1 934 209	1 979 007	
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 498	95 000	102 336	115 173	
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 162	167 148	192 469	207 351	233 355	
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09		tonnes	363 667	372 563	428 995	462 186	520 114	
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 308	74 106	
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 408	96 592	94 560	92 609	90 685	
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811	
	TOTAL					0 6.15E+11	6.41E+11	6.78E+11	6.40E+11	6.49E+11			42 281 126	44 033 769	46 642 549	44 103 379	44 759 736	0
						RELATIVE TO 1988 ENERGY USE		110.3%	104.1%	105.5%		RELATIVE TO 1988 EMISSIONS			110.3%	104.3%	105.9%	

Table E.1.2

Scenario 1: Actions Economically Attractive to Society

SCENARIO EMISSIONS

SCENARIO EMISSIONS

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		Units	Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	341	371	409		tonnes	3 668	3 811	4 293	4 668	5 140	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	690	750	826		tonnes	5 436	4 502	3 731	2 599	2 696	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	50	54	59		tonnes	916	830	848	826	896	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	80	87	96		tonnes	669	695	783	852	938	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	129	139	158		tonnes	1 064	1 081	1 261	1 351	1 541	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 325	1 985	1 938		tonnes	62 626	42 841	35 781	25 536	26 433	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	309	469	631		tonnes	676	889	1 943	3 165	4 674	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	531	487	493		tonnes	8 717	6 069	5 649	4 974	5 351	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	131	120	122		tonnes	208	197	201	202	235	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	933	983	1 052		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 864	7 617	7 964		tonnes	52 850	46 690	43 595	35 429	36 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280		tonnes	21 125	21 078	23 694	26 278	28 676	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 538		tonnes	3 132	3 370	4 409	5 149	5 895	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307		tonnes	651	619	576	690	810	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025		tonnes	5 895	6 286	7 104	7 383	7 758	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	121	126	133		tonnes	1 385	1 417	1 524	1 588	1 670	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 300	3 504	3 754		tonnes	10 489	9 019	7 425	5 155	5 313	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4		tonnes	28	27	27	27	29	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	534	789	1 029		tonnes	387	512	1 114	1 811	2 664	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 658	3 876	3 663		tonnes	83 703	58 114	48 111	34 137	35 027	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	505	454	450		tonnes	8 253	5 831	5 427	4 778	5 141	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	125	112	111		tonnes	168	189	193	194	225	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	735	654	574		tonnes	14 065	10 003	9 348	8 410	7 605	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	417	476	501		tonnes	341	379	545	636	759	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	259	211	168		tonnes	426	395	358	297	255	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 981	4 076	4 171		tonnes	5 666	4 944	4 130	3 158	3 419	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6		tonnes	38	39	45	49	55	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11		tonnes	73	74	86	92	104	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25		tonnes	173	178	204	220	248	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53		tonnes	770	520	458	359	401	
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30		tonnes	668	601	533	468	451	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203		tonnes	3 160	2 297	2 420	2 518	2 782	
	TOTAL				0	32 842	33 889	36 625	38 271	40 598	0	0	306 597	242 704	225 490	193 646	206 987	0

Table E.1.2

Scenario 1: Actions Economically Attractive to Society

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	206	227	250		tonnes	198	206	232	252	277	
2	Inter-city	Public	Bus	Diesel	tonnes	567	425	438	432	456		tonnes	292	292	329	357	393	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	609	549	563		tonnes	136	136	153	167	184	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	896	974	1 072		tonnes	56	58	65	71	78	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	105	112	128	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	52 251	41 749	43 614		tonnes	10 809	11 560	12 873	13 781	14 979	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	613	1 067	1 610		tonnes	236	351	862	1 600	2 337	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	8 026	6 812	7 404		tonnes	1 353	1 394	1 600	1 838	2 115	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	63	68	81		tonnes	73	78	89	102	117	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 418	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344		tonnes	182	196	256	299	342	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70		tonnes	179	170	158	189	222	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769		tonnes	342	365	412	429	450	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	74	77	81		tonnes	75	76	82	86	90	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	872	858	919		tonnes	563	584	654	709	775	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	20	18	19		tonnes	4	4	5	5	6	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	351	610	918		tonnes	135	202	494	915	1 332	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	70 257	55 812	57 794		tonnes	14 446	15 681	17 310	18 423	19 849	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 711	6 544	7 114		tonnes	1 281	1 339	1 536	1 766	2 033	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	61	65	78		tonnes	59	75	86	98	113	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 711	6 865	6 245		tonnes	1 632	1 700	1 766	1 787	1 712	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	172	214	262		tonnes	119	150	242	321	380	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166		tonnes	63	65	65	60	52	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591		tonnes	304	320	364	434	499	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63		tonnes	3	3	4	4	5	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119		tonnes	6	6	7	8	9	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284		tonnes	14	15	17	18	21	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661		tonnes	133	142	166	194	227	
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293		tonnes	99	96	96	94	92	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284		tonnes	367	391	457	535	626	
	TOTAL					0 241 480	190 347	172 516	138 347	145 485	0		0 37 820	40 520	46 261	51 685	57 391	0

Table E.1.2 SCENARIO EMISSIONS

Scenario 1: Actions Economically Attractive to Society

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 717	1 867	2 055	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 244	2 299	2 511	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 946	4 373	4 412	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 503	2 722	2 997	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	4 032	4 318	4 926	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	382 038	310 483	329 531	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 474	2 632	3 947	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	66 867	59 628	65 518	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	152	168	198	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 367	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 426	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 508	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	586	609	635	668	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 466	4 560	4 950	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	192	141	142	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	845	1 505	2 250	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	513 692	415 065	436 667	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	64 245	57 290	62 948	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	146	161	190	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	79 771	62 652	57 312	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	414	529	641	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 738	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	18 761	20 965	
	TOTAL				0	1 895 797	1 344 440	1 218 153	1 019 012	1 078 999	0

E.1.3 Strategy 3: Combined instruments

Measures applied:

- Subsidies/incentives for public transit — low
  → increase transit mode split to 13 per cent
  → reduce urban travel demand 5 per cent
- Incentives for communications use → reduce passenger vehicle travel demand 5 per cent
- New CAFE standards — low → reduce passenger vehicle fuel consumption 20 per cent
  → reduce truck fuel consumption 10 per cent
- Urban traffic management — low → reduce urban fuel consumption 5 per cent
- Inspection and maintenance programs → reduce passenger vehicle fuel consumption 5 per cent

Table E.1.3

Scenario 1: Actions Economically Attractive to Society

Strategy 3: Combined Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.96	0.81	0.76
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.96	0.81	0.76
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.96	0.81	0.76
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.96	0.81	0.76
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.89	0.86
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.89	0.86
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
25	Urban	Public	GO-Train	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.99	0.97	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.90	1.00	1.00	0.99	0.97	0.95
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.97	0.94	0.90	1.00	1.00	0.95	0.79	0.72
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.97	0.94	0.90	1.00	1.00	0.95	0.79	0.72
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.97	0.94	0.90	1.00	1.00	0.95	0.79	0.72
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.97	0.94	0.90	1.00	1.00	0.95	0.79	0.72
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.87	0.81
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.1.3

Scenario 1: Actions Economically Attractive to Society

Strategy 3: Combined Instruments

						CHANGE IN TRANSPORTATION DEMAND						CHANGE IN EFFICIENCY					
								C'	(I'C)					D'	(II'D)		
						Revised Vehicle Demand						Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.69E+09	1.80E+09	1.96E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00	
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.70E+09	1.81E+09	1.97E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01	
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.20E+08	1.28E+08	1.40E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01	
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	4.95E+09	5.28E+09	5.75E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00	
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.74E+06	6.02E+06	6.79E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03	
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.71E+10	3.89E+10	4.19E+10	MJ/pass.km	3.09E+00	3.01E+00	2.83E+00	2.25E+00	2.02E+00	
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.88E+09	3.41E+09	4.93E+09	MJ/pass.km	1.30E+00	1.22E+00	1.08E+00	8.85E-01	8.16E-01	
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.61E+09	5.19E+09	5.91E+09	MJ/pass.km	5.85E+00	5.74E+00	5.19E+00	4.15E+00	3.65E+00	
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.94E+08	2.18E+08	2.48E+08	MJ/pass.km	5.08E+00	4.93E+00	4.46E+00	3.56E+00	3.13E+00	
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.62E+00	4.15E+00	3.88E+00	
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.55E+00	1.35E+00	1.23E+00	
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01	
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01	
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07	
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.40E-01	4.27E-01	4.14E-01	
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.83E+07	1.94E+07	2.10E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01	
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.39E+09	3.59E+09	3.89E+09	MJ/pass.km	2.11E+00	2.11E+00	2.09E+00	2.05E+00	2.00E+00	
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.88E+06	4.14E+06	4.25E+06	MJ/pass.km	2.23E+00	2.23E+00	2.21E+00	2.16E+00	2.12E+00	
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.96E+06	1.25E+07	2.35E+07	MJ/pass.km	5.92E-01	3.28E+00	1.55E+00	1.88E+00	1.91E+00	
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.07E+09	1.91E+09	2.67E+09	MJ/pass.km	3.96E+00	3.74E+00	3.26E+00	2.60E+00	2.33E+00	
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.94E+10	5.10E+10	5.27E+10	MJ/pass.km	4.58E+00	4.50E+00	4.21E+00	3.29E+00	2.89E+00	
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.39E+09	4.89E+09	5.40E+09	MJ/pass.km	5.83E+00	5.74E+00	5.14E+00	4.02E+00	3.47E+00	
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.84E+08	2.05E+08	2.26E+08	MJ/pass.km	5.01E+00	4.93E+00	4.41E+00	3.45E+00	2.97E+00	
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	MJ/pass.km	7.24E+00	7.13E+00	6.51E+00	5.72E+00	5.24E+00	
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	MJ/pass.km	5.66E+00	5.57E+00	5.21E+00	4.48E+00	3.99E+00	
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.77E+00	3.31E+00	3.03E+00	
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.62E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	9.46E+00	8.12E+00	7.23E+00	
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
	TOTAL																**

Table E.1.3

Scenario 1: Actions Economically Attractive to Society

Strategy 3: Combined Instruments

REVISED ENERGY USE

E' (C"D')

Strategy Energy Use (Megajoules)

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE			1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	MJ/a		2.55E+09	2.65E+09	2.93E+09	3.12E+09	3.40E+09
2	Inter-city	Public	Bus	Diesel	MJ/a		1.34E+09	1.34E+09	1.48E+09	1.57E+09	1.72E+09
3	Inter-city	Public	Bus	Gasoline	MJ/a		9.98E+07	9.99E+07	1.10E+08	1.17E+08	1.28E+08
4	Inter-city	Public	Intra-air	Turbo	MJ/a		1.98E+10	2.06E+10	2.27E+10	2.42E+10	2.64E+10
5	Inter-city	Public	Extra-air	Turbo	MJ/a		3.15E+10	3.20E+10	3.66E+10	3.84E+10	4.34E+10
6	Inter-city	Private	Auto	Gasoline	MJ/a		9.83E+10	1.02E+11	1.05E+11	8.77E+10	8.47E+10
7	Inter-city	Private	Auto	Diesel	MJ/a		6.83E+08	9.54E+08	2.03E+09	3.02E+09	4.02E+09
8	Inter-city	Private	Light truck	Gasoline	MJ/a		2.33E+10	2.35E+10	2.40E+10	2.15E+10	2.16E+10
9	Inter-city	Private	Light truck	Diesel	MJ/a		8.20E+08	8.49E+08	8.65E+08	7.76E+08	7.75E+08
10	Inter-city	General freight	Truck	Gasoline	MJ/a		4.11E+10	4.15E+10	4.29E+10	4.52E+10	4.84E+10
11	Inter-city	General freight	Truck	Diesel	MJ/a		4.00E+10	4.14E+10	4.61E+10	5.11E+10	5.35E+10
12	Inter-city	General freight	Rail	Diesel	MJ/a		1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10
13	Inter-city	General freight	Marine	Diesel	MJ/a		3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09
14	Inter-city	General freight	Marine	Heavy FO	MJ/a		6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09
15	Inter-city	General freight	Marine	Light FO	MJ/a		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
16	Inter-city	General freight	Marine	Kerosene	MJ/a		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
17	Inter-city	General freight	Marine	Coal	MJ/a		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
18	Inter-city	Specific freight	Rail	Diesel	MJ/a		5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09
19	Inter-city	Specific freight	Marine	Diesel	MJ/a		7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a		6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03
21	Inter-city	Specific freight	Marine	Light FO	MJ/a		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
23	Inter-city	Specific freight	Marine	Coal	MJ/a		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a		1.22E+09	1.26E+09	1.39E+09	1.46E+09	1.55E+09
25	Urban	Public	GO-Train	Diesel	MJ/a		9.64E+08	9.86E+08	1.04E+09	1.06E+09	1.10E+09
26	Urban	Public	Bus	Diesel	MJ/a		6.27E+09	6.51E+09	7.07E+09	7.35E+09	7.80E+09
27	Urban	Public	Bus	Gasoline	MJ/a		7.52E+06	7.83E+06	8.55E+06	8.93E+06	9.00E+06
28	Urban	Private passenger	Auto	Electricity	MJ/a		8.70E+05	1.06E+06	6.13E+06	2.34E+07	4.49E+07
29	Urban	Private passenger	Auto	Diesel	MJ/a		1.19E+09	1.68E+09	3.48E+09	4.98E+09	6.24E+09
30	Urban	Private passenger	Auto	Gasoline	MJ/a		1.95E+11	2.08E+11	2.08E+11	1.68E+11	1.52E+11
31	Urban	Private passenger	Light truck	Gasoline	MJ/a		2.20E+10	2.26E+10	2.26E+10	1.97E+10	1.87E+10
32	Urban	Private passenger	Light truck	Diesel	MJ/a		6.54E+08	8.16E+08	8.14E+08	7.09E+08	6.72E+08
33	Urban	Non-freight	Truck	Gasoline	MJ/a		3.48E+10	3.57E+10	3.38E+10	3.01E+10	2.64E+10
34	Urban	Non-freight	Truck	Diesel	MJ/a		1.50E+09	1.85E+09	2.80E+09	3.20E+09	3.36E+09
35	Urban	Freight	Truck	Gasoline	MJ/a		1.29E+10	1.30E+10	1.19E+10	9.69E+09	7.72E+09
36	Urban	Freight	Truck	Diesel	MJ/a		2.43E+10	2.51E+10	2.67E+10	2.74E+10	2.80E+10
37	Aviation	General	Airplane	Turbo	MJ/a		1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09
38	Aviation	General	Airplane	Aviation gas	MJ/a		2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09
39	Aviation	Government	Airplane	Turbo	MJ/a		5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09
40	Aviation	Government	Airplane	Aviation gas	MJ/a		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41	Other	Private	Motorcycle	Gasoline	MJ/a		6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09
42	Other	Other	School bus	Gasoline	MJ/a		1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09
43	Other	Private	Leisure vehicle	Gasoline	MJ/a		6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10
	TOTAL					0	6.15E+11	6.41E+11	6.67E+11	6.20E+11	6.19E+11
					RELATIVE TO 1988 ENERGY USE			108.4%	100.8%	100.7%	

SCENARIO EMISSIONS

Strategy Tonnes of CO2

NUMBER		1988	1990	1995	2000	2005
1	tonnes	180 342	187 375	206 898	220 377	240 093
2	tonnes	94 572	94 612	104 473	111 283	121 233
3	tonnes	6 787	6 790	7 497	7 986	8 700
4	tonnes	1 403 880	1 458 577	1 610 547	1 715 539	1 868 940
5	tonnes	2 232 781	2 267 014	2 593 629	2 721 252	3 072 163
6	tonnes	6 683 943	6 960 600	7 126 313	5 960 389	5 756 811
7	tonnes	48 290	67 438	143 614	213 524	284 457
8	tonnes	1 584 182	1 599 426	1 628 254	1 462 940	1 465 903
9	tonnes	57 983	60 037	61 121	54 841	54 785
10	tonnes	2 793 483	2 820 366	2 918 329	3 073 260	3 290 119
11	tonnes	2 825 701	2 925 785	3 256 923	3 614 423	3 778 870
12	tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080
13	tonnes	276 181	297 184	388 828	454 124	519 900
14	tonnes	501 341	476 603	443 478	531 097	623 454
15	tonnes	0	0	0	0	0
16	tonnes	0	0	0	0	0
17	tonnes	0	0	0	0	0
18	tonnes	396 820	402 367	423 757	469 080	503 513
19	tonnes	519 888	554 396	626 499	651 106	684 243
20	tonnes	1	1	0	0	0
21	tonnes	0	0	0	0	0
22	tonnes	0	0	0	0	0
23	tonnes	0	0	0	0	0
24	tonnes	0	0	0	0	0
25	tonnes	68 125	69 660	73 445	74 953	77 989
26	tonnes	443 056	460 243	499 742	519 825	551 122
27	tonnes	511	532	581	607	612
28	tonnes	0	0	0	0	0
29	tonnes	83 829	118 817	245 721	352 133	440 812
30	tonnes	13 241 454	14 118 327	14 132 013	11 402 652	10 337 892
31	tonnes	1 493 131	1 536 705	1 533 269	1 336 135	1 271 096
32	tonnes	46 205	57 682	57 555	50 068	47 504
33	tonnes	2 363 984	2 424 810	2 299 783	2 044 167	1 793 962
34	tonnes	105 714	130 850	197 906	225 948	237 699
35	tonnes	878 445	884 666	808 947	658 596	524 911
36	tonnes	1 717 010	1 775 824	1 889 124	1 934 209	1 979 007
37	tonnes	80 529	82 498	95 000	102 336	115 173
38	tonnes	163 162	167 148	192 469	207 351	233 355
39	tonnes	363 667	372 563	429 995	462 166	520 114
40	tonnes	0	0	0	0	0
41	tonnes	43 381	46 202	54 083	63 308	74 106
42	tonnes	97 408	96 592	94 580	92 609	90 685
43	tonnes	446 559	475 591	556 719	651 679	762 811
		42 281 126	44 033 769	45 865 211	42 732 165	42 742 115
	RELATIVE TO 1988 EMISSIONS			108.5%	101.1%	101.1%

Table E.1.3

Scenario 1: Actions Economically Attractive to Society

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	334	356	388		tonnes	3 668	3 811	4 208	4 482	4 883	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	676	720	785		tonnes	5 436	4 502	3 657	2 495	2 561	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	49	52	56		tonnes	916	830	831	793	851	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	79	84	91		tonnes	669	695	768	818	891	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	127	133	150		tonnes	1 064	1 081	1 236	1 297	1 464	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 279	1 906	1 841		tonnes	62 626	42 841	35 065	24 514	25 111	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	303	450	599		tonnes	676	889	1 904	3 038	4 440	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	521	468	469		tonnes	8 717	6 069	5 536	4 775	5 083	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	129	116	115		tonnes	208	197	197	194	223	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	933	983	1 052		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 864	7 617	7 964		tonnes	52 850	46 690	43 595	35 429	38 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280		tonnes	21 125	21 078	23 694	26 278	28 676	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 538		tonnes	3 132	3 370	4 409	5 149	5 895	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307		tonnes	651	619	576	690	810	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025		tonnes	5 895	6 286	7 104	7 383	7 758	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	119	121	126		tonnes	1 385	1 417	1 494	1 524	1 586	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 234	3 364	3 566		tonnes	10 489	9 019	7 277	4 949	5 048	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4		tonnes	28	27	27	26	26	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	518	742	929		tonnes	387	512	1 081	1 703	2 404	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 519	3 646	3 306		tonnes	83 703	58 114	46 677	32 116	31 612	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	490	427	406		tonnes	8 253	5 831	5 266	4 496	4 640	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	121	106	100		tonnes	168	189	187	183	203	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	735	654	574		tonnes	14 065	10 003	9 348	8 410	7 605	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	417	476	501		tonnes	341	379	545	636	759	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	259	211	168		tonnes	426	395	358	297	255	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 981	4 076	4 171		tonnes	5 666	4 944	4 130	3 158	3 419	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6		tonnes	38	39	45	49	55	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11		tonnes	73	74	86	92	104	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25		tonnes	173	178	204	220	248	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53		tonnes	770	520	458	359	401	
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30		tonnes	668	601	533	468	451	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203		tonnes	3 160	2 297	2 420	2 518	2 782	
	TOTAL					0 32 842	33 889	36 291	37 637	39 654	0		0 306 597	242 704	222 586	189 185	200 042	0

Table E.1.3

Scenario 1: Actions Economically Attractive to Society

SCENARIO EMISSIONS

SCENARIO EMISSIONS

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	204	218	237		tonnes	198	206	227	242	263	
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	430	415	443		tonnes	292	292	322	343	374	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	597	527	554		tonnes	136	136	150	160	174	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	878	935	1 019		tonnes	56	58	64	68	74	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	103	108	122	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	51 206	40 079	41 434		tonnes	10 809	11 560	12 616	13 230	14 230	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	600	1 024	1 529		tonnes	236	351	844	1 536	2 220	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 865	6 539	7 034		tonnes	1 353	1 394	1 568	1 765	2 010	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	62	65	77		tonnes	73	78	87	98	111	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 418	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344		tonnes	182	196	256	299	342	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70		tonnes	179	170	158	189	222	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769		tonnes	342	365	412	429	450	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	73	74	77		tonnes	75	76	81	82	86	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	855	823	873		tonnes	563	584	641	681	737	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	19	17	17		tonnes	4	4	5	5	5	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	341	574	828		tonnes	135	202	479	861	1 202	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	68 164	52 508	52 159		tonnes	14 446	15 681	16 794	17 333	17 913	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 481	6 157	6 420		tonnes	1 281	1 339	1 492	1 661	1 834	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	59	62	70		tonnes	59	75	83	92	102	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 711	6 885	6 245		tonnes	1 632	1 700	1 766	1 787	1 712	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	172	214	262		tonnes	119	150	242	321	380	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166		tonnes	63	65	65	60	52	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591		tonnes	304	320	364	434	499	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63		tonnes	3	3	4	4	5	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119		tonnes	6	6	7	8	9	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284		tonnes	14	15	17	18	21	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661		tonnes	133	142	166	194	227	
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293		tonnes	99	98	96	94	92	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284		tonnes	367	391	457	535	626	
	TOTAL				0	241 480	190 347	188 899	132 502	136 253	0	0	37 820	40 520	45 341	49 667	54 042	0

Table E.1.3 SCENARIO EMISSIONS

Scenario 1: Actions Economically Attractive to Society

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units		Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes		1 466	1 524	1 682	1 792	1 952	
2	Inter-city	Public	Bus	Diesel	tonnes		2 444	2 107	2 199	2 207	2 386	
3	Inter-city	Public	Bus	Gasoline	tonnes		12 230	6 985	5 827	4 198	4 192	
4	Inter-city	Public	Intra-air	Turbo	tonnes		2 139	2 222	2 453	2 613	2 847	
5	Inter-city	Public	Extra-air	Turbo	tonnes		3 401	3 453	3 951	4 145	4 680	
6	Inter-city	Private	Auto	Gasoline	tonnes		613 547	425 693	374 397	298 063	313 055	
7	Inter-city	Private	Auto	Diesel	tonnes		424	624	1 445	2 528	3 750	
8	Inter-city	Private	Light truck	Gasoline	tonnes		99 950	71 265	65 530	57 243	62 242	
9	Inter-city	Private	Light truck	Diesel	tonnes		131	138	149	161	188	
10	Inter-city	General freight	Truck	Gasoline	tonnes		14 676	8 631	7 367	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes		23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes		8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes		1 332	1 434	1 876	2 191	2 508	
14	Inter-city	General freight	Marine	Heavy FO	tonnes		0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes		0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes		0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes		0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes		3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes		2 508	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes		0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes		0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes		0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes		0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes		0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes		554	566	597	609	634	
26	Urban	Public	Bus	Diesel	tonnes		4 716	4 221	4 376	4 377	4 702	
27	Urban	Public	Bus	Gasoline	tonnes		379	226	188	136	128	
28	Urban	Private passenger	Auto	Electricity	tonnes		0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes		243	359	820	1 416	2 030	
30	Urban	Private passenger	Auto	Gasoline	tonnes		820 038	577 447	498 384	390 493	394 092	
31	Urban	Private passenger	Light truck	Gasoline	tonnes		94 632	68 470	62 330	53 898	56 811	
32	Urban	Private passenger	Light truck	Diesel	tonnes		106	132	142	152	172	
33	Urban	Non-freight	Truck	Gasoline	tonnes		130 332	94 025	79 771	62 652	57 312	
34	Urban	Non-freight	Truck	Diesel	tonnes		214	266	414	529	641	
35	Urban	Freight	Truck	Gasoline	tonnes		5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes		2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes		123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes		232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes		554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes		0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes		7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes		8 925	5 052	3 738	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes		29 281	21 594	20 652	18 761	20 965	
	TOTAL					0	1 895 797	1 344 440	1 191 456	975 197	1 008 949	0

Appendix E.2 Scenario 2: Zero per cent increase in CO_2 emissions relative to 1988 by 2000

E.2.1 Strategy 1: Economic instruments

Measures applied:

- Carbon tax for stable emissions by 2000 → reduce fuel consumption 18 per cent
- Carbon tax — low → reduce passenger vehicle travel 3 per cent

Table E.2.1

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 1: Economic Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.99	0.98	0.97	1.00	1.00	0.92	0.82	0.82
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.82	0.82
	TOTAL													

Table E.2.1

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 1: Economic Instruments

						CHANGE IN TRANSPORTATION DEMAND C' (I'C) Revised Vehicle Demand						CHANGE IN EFFICIENCY D' (II'D) Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.59E+00	4.59E+00	4.22E+00	3.76E+00	3.76E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6.38E+03	6.38E+03	5.87E+03	5.22E+03	5.22E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.75E+10	3.97E+10	4.27E+10	MJ/pass.km	3.09E+00	3.01E+00	2.71E+00	2.26E+00	2.18E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.90E+09	3.48E+09	5.04E+09	MJ/pass.km	1.30E+00	1.22E+00	1.04E+00	8.88E-01	8.78E-01
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.66E+09	5.30E+09	6.04E+09	MJ/pass.km	5.85E+00	5.74E+00	4.97E+00	4.16E+00	3.93E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.96E+08	2.22E+08	2.53E+08	MJ/pass.km	5.08E+00	4.93E+00	4.27E+00	3.58E+00	3.37E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.39E+00	3.80E+00	3.71E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.47E+00	1.24E+00	1.18E+00
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.70E-01	1.47E-01	1.44E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	3.96E-01	3.52E-01	3.52E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.96E-01	3.52E-01	3.52E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.96E-01	3.52E-01	3.52E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.96E-01	3.52E-01	3.52E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.02E-01	1.75E-01	1.71E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	2.76E-07	2.46E-07	2.46E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.36E-07	6.55E-07	6.55E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.36E-07	6.55E-07	6.55E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.36E-07	6.54E-07	6.54E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.45E-01	4.41E-01	4.36E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.74E+09	4.10E+09	MJ/pass.km	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.31E+06	4.73E+06	MJ/pass.km	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.96E+06	1.25E+07	2.35E+07	MJ/pass.km	5.92E-01	3.28E+00	1.56E+00	1.94E+00	2.01E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.09E+09	1.99E+09	2.87E+09	MJ/pass.km	3.96E+00	3.74E+00	3.16E+00	2.69E+00	2.65E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	5.04E+10	5.31E+10	5.66E+10	MJ/pass.km	4.58E+00	4.50E+00	4.07E+00	3.41E+00	3.27E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.48E+09	5.09E+09	5.80E+09	MJ/pass.km	5.83E+00	5.74E+00	4.97E+00	4.16E+00	3.93E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.88E+08	2.14E+08	2.43E+08	MJ/pass.km	5.01E+00	4.93E+00	4.27E+00	3.58E+00	3.37E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	MJ/pass.km	7.24E+00	7.13E+00	6.24E+00	5.41E+00	5.28E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	MJ/pass.km	5.66E+00	5.57E+00	4.99E+00	4.23E+00	4.01E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.61E+00	3.13E+00	3.05E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	9.07E+00	7.67E+00	7.28E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	9.20E-01	8.18E-01	8.18E-01
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	9.20E-01	8.18E-01	8.18E-01
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	9.20E-01	8.18E-01	8.18E-01
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	9.20E-01	8.18E-01	8.18E-01
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	9.20E-01	8.18E-01	8.18E-01
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	9.20E-01	8.18E-01	8.18E-01
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	9.20E-01	8.18E-01	8.18E-01
	TOTAL															

Table E.2.1

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 1: Economic Instruments

REVISED ENERGY USE — E' (C''D')

SCENARIO EMISSIONS — Strategy Tonnes of CO2

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (Megajoules) 1988	1990	1995	2000	2005			Tonnes of CO2 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09		tonnes	180 342	187 375	211 120	229 560	252 729	
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09		tonnes	94 572	94 612	106 605	115 920	127 614	
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08		tonnes	6 787	6 790	7 650	8 319	9 158	
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.13E+10	2.06E+10	2.27E+10		tonnes	1 403 880	1 456 577	1 511 942	1 461 782	1 609 256	
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.44E+10	3.27E+10	3.73E+10		tonnes	2 232 781	2 267 014	2 434 836	2 318 734	2 645 294	
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.01E+11	8.99E+10	9.31E+10	6	tonnes	6 683 943	6 960 600	6 896 916	6 106 460	6 326 591	
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	1.97E+09	3.10E+09	4.42E+09		tonnes	48 290	67 438	138 991	218 828	312 611	
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.32E+10	2.21E+10	2.37E+10		tonnes	1 584 182	1 599 428	1 575 840	1 499 283	1 610 991	
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.37E+08	7.95E+08	8.52E+08		tonnes	57 963	60 037	59 153	56 204	60 207	
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.07E+10	4.14E+10	4.63E+10		tonnes	2 793 483	2 820 366	2 767 329	2 817 040	3 147 740	
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.37E+10	4.69E+10	5.11E+10	11	tonnes	2 825 701	2 925 785	3 088 404	3 313 086	3 615 340	
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.06E+09	5.26E+09	6.02E+09		tonnes	276 181	297 184	357 721	371 473	425 278	
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.06E+09	5.39E+09	6.32E+09		tonnes	501 341	476 603	408 000	434 437	509 985	
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 080	503 513	
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.15E+09	7.54E+09	7.92E+09		tonnes	519 888	554 396	576 379	532 604	559 710	
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	4.77E+03	4.52E+03	4.87E+03		tonnes	1	1	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.40E+09	1.50E+09	1.63E+09		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09		tonnes	68 125	69 660	74 944	78 076	82 094	
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.29E+09	7.90E+09	8.64E+09	26	tonnes	443 056	460 243	515 091	558 231	610 662	
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.81E+06	9.59E+06	1.05E+07		tonnes	511	532	599	652	716	
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.06E+06	6.19E+06	2.42E+07	4.73E+07		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.43E+09	5.37E+09	7.59E+09		tonnes	83 829	118 617	242 639	379 635	536 778	
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	2.05E+11	1.81E+11	1.85E+11		tonnes	13 241 454	14 118 327	13 954 801	12 293 207	12 588 460	
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.23E+10	2.12E+10	2.28E+10	31	tonnes	1 493 131	1 536 705	1 514 042	1 440 488	1 547 815	
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	8.04E+08	7.64E+08	8.18E+08		tonnes	46 205	57 682	56 833	54 000	57 846	
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.24E+10	2.84E+10	2.66E+10		tonnes	2 363 984	2 424 810	2 202 816	1 931 694	1 806 661	
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.68E+09	3.02E+09	3.39E+09		tonnes	105 714	130 650	189 564	213 516	239 382	
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.14E+10	9.16E+09	7.78E+09		tonnes	878 445	884 666	774 839	622 359	528 627	
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.56E+10	2.59E+10	2.82E+10	36	tonnes	1 717 010	1 775 824	1 809 472	1 827 787	1 993 017	
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.23E+09	1.18E+09	1.33E+09		tonnes	80 529	82 496	87 400	83 713	94 212	
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.33E+09	2.23E+09	2.51E+09		tonnes	163 162	167 148	177 072	169 613	190 884	
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	5.57E+09	5.34E+09	6.01E+09		tonnes	363 667	372 563	394 675	378 052	425 453	
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.32E+08	7.62E+08	8.92E+08	41	tonnes	43 381	46 202	49 757	51 786	60 619	
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.28E+09	1.11E+09	1.09E+09		tonnes	97 408	96 592	87 013	75 754	74 180	
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	7.53E+09	7.84E+09	9.18E+09		tonnes	446 559	475 591	512 181	533 074	623 979	
	TOTAL				0	6.15E+11	6.41E+11	6.45E+11	6.09E+11	6.47E+11			42 281 126	44 033 769	44 373 500	41 936 626	44 567 483	0
				RELATIVE TO 1988 ENERGY USE			104.9%	99.1%	105.2%			RELATIVE TO 1988 EMISSIONS		104.9%	99.2%	105.5%		

Table E.2.1

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	341	371	409		tonnes	3 668	3 811	4 293	4 668	5 140	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	690	750	826		tonnes	5 436	4 502	3 731	2 599	2 696	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	50	54	59		tonnes	916	830	848	826	896	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	74	71	79		tonnes	669	695	721	697	767	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	119	113	129		tonnes	1 064	1 081	1 161	1 105	1 261	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 206	1 953	2 023		tonnes	62 626	42 841	35 423	25 025	25 640	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	293	461	659		tonnes	676	889	1 924	3 102	4 534	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	504	479	515		tonnes	8 717	6 069	5 592	4 874	5 190	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	125	118	127		tonnes	208	197	199	198	228	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	885	901	1 007		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 509	6 982	7 619		tonnes	52 850	46 690	43 595	35 429	38 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280		tonnes	21 125	21 078	23 694	26 278	28 676	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 059	1 099	1 258		tonnes	3 132	3 370	4 056	4 212	4 822	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 473	3 696	4 341		tonnes	651	619	530	564	662	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 706	1 576	1 656		tonnes	5 895	6 286	6 535	6 039	6 346	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	121	126	133		tonnes	1 385	1 417	1 524	1 588	1 670	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 333	3 612	3 952		tonnes	10 489	9 019	7 425	5 155	5 313	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	5		tonnes	28	27	27	27	29	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	511	800	1 131		tonnes	387	512	1 103	1 774	2 584	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 462	3 931	4 026		tonnes	83 703	58 114	47 630	33 454	33 976	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	484	461	495		tonnes	8 253	5 831	5 373	4 683	4 987	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	120	114	122		tonnes	168	189	191	190	219	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	704	618	578		tonnes	14 065	10 003	9 348	8 410	7 605	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	400	450	504		tonnes	341	379	545	636	759	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	248	199	169		tonnes	426	395	358	297	255	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 813	3 852	4 200		tonnes	5 666	4 944	4 130	3 158	3 419	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	4	4	5		tonnes	38	39	42	40	45	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	8	8	9		tonnes	73	74	79	75	85	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	19	18	21		tonnes	173	178	188	180	203	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	36	37	44		tonnes	770	520	421	294	328	
42	Other	Other	School bus	Gasoline	tonnes	32	32	29	25	24		tonnes	668	601	490	383	369	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	136	142	166		tonnes	3 160	2 297	2 227	2 060	2 276	
	TOTAL				0	32 842	33 869	35 034	35 878	39 384	0	0	306 597	242 704	223 075	188 668	200 776	0

Table E.2.1

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	208	227	250		tonnes	198	206	232	252	277	
2	Inter-city	Public	Bus	Diesel	tonnes	567	425	438	432	466		tonnes	292	292	329	357	393	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	609	549	583		tonnes	136	136	153	167	184	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	824	797	877		tonnes	56	58	60	58	64	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	97	92	105	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	51 728	40 914	42 306		tonnes	10 809	11 560	12 745	13 506	14 529	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	607	1 045	1 562		tonnes	236	351	853	1 568	2 267	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 946	6 675	7 182		tonnes	1 353	1 394	1 584	1 801	2 052	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	63	67	78		tonnes	73	78	88	100	114	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 406	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 418	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	925	961	1 100		tonnes	182	196	236	245	280	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	46	49	58		tonnes	179	170	145	155	182	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 490	1 377	1 447		tonnes	342	365	379	351	368	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	74	77	81		tonnes	75	76	82	86	90	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	872	858	919		tonnes	563	584	654	709	775	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	20	18	19		tonnes	4	4	5	5	6	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	348	598	890		tonnes	135	202	489	897	1 292	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	69 555	54 695	56 060		tonnes	14 446	15 681	17 137	18 055	19 253	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 634	6 414	6 900		tonnes	1 281	1 339	1 522	1 731	1 972	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	60	64	75		tonnes	59	75	85	96	109	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 711	6 885	6 245		tonnes	1 632	1 700	1 766	1 787	1 712	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	172	214	262		tonnes	119	150	242	321	380	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166		tonnes	63	65	65	60	52	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591		tonnes	304	320	364	434	499	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	48	46	51		tonnes	3	3	3	3	4	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	90	86	97		tonnes	6	6	7	6	7	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	215	206	232		tonnes	14	15	16	15	17	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	903	481	541		tonnes	133	142	152	159	186	
42	Other	Other	School bus	Gasoline	tonnes	792	457	560	254	240		tonnes	99	98	89	77	76	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	4 917	1 687	1 869		tonnes	367	391	421	436	512	
	TOTAL					0 241 480	190 347	170 252	134 770	140 478	0		0 37 820	40 520	45 773	50 559	55 704	0

Table E.2.1

SCENARIO EMISSIONS

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 717	1 867	2 055	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 244	2 299	2 511	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 946	4 373	4 412	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 303	2 227	2 451	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	3 709	3 532	4 030	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	378 217	304 273	319 645	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 459	2 579	3 829	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	66 199	58 436	63 552	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	151	165	192	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 726	1 792	2 052	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	2 781	2 570	2 700	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	609	635	668	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 466	4 560	4 950	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	192	141	142	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	837	1 475	2 182	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	508 555	406 763	423 567	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	63 603	56 144	61 060	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	145	158	185	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	79 771	62 652	57 312	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	414	529	641	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	133	128	144	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	252	241	271	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	601	576	648	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 524	3 575	4 086	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 439	2 025	1 817	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	19 000	15 346	17 149	
	TOTAL				0	1 895 797	1 344 440	1 204 513	994 951	1 044 097	0

E.2.2 Strategy 2: Regulatory instruments

Measures applied:

- New CAFE standards — medium → reduce passenger vehicle fuel consumption 26 per cent
  → reduce truck fuel consumption 13 per cent
- Urban traffic management — low → reduce urban travel demand 10 per cent
- Inspection and maintenance programs → reduce passenger vehicle fuel consumption 5 per cent
- Passenger vehicle travel restrictions → reduce urban travel demand 10 per cent

Table E.2.2

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 2: Regulatory Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS					CHANGE IN EFFICIENCY COEFFICIENTS				
					I.					II.				
					Vehicle Demand					Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.95	0.78	0.70
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.95	0.78	0.70
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.95	0.78	0.70
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.95	0.78	0.70
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.87	0.83
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.87	0.83
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.94	0.75	0.67
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.94	0.75	0.67
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.94	0.75	0.67
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.94	0.75	0.67
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.96	0.85	0.79
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.96	0.85	0.79
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.85	0.79
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.85	0.79
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.2.2

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 2: Regulatory Instruments

						CHANGE IN TRANSPORTATION DEMAND						CHANGE IN EFFICIENCY					
						C'	(I'C)					D'	(II'D)				
						Revised Vehicle Demand						Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00	MJ/pass.km
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01	MJ/pass.km
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01	MJ/pass.km
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00	MJ/pass.km
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03	MJ/pass.km
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.75E+10	3.93E+10	4.19E+10	MJ/pass.km	3.09E+00	3.01E+00	2.80E+00	2.15E+00	1.87E+00	MJ/pass.km
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.90E+09	3.45E+09	4.93E+09	MJ/pass.km	1.30E+00	1.22E+00	1.07E+00	8.43E-01	7.55E-01	MJ/pass.km
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.66E+09	5.24E+09	5.91E+09	MJ/pass.km	5.85E+00	5.74E+00	5.14E+00	3.95E+00	3.37E+00	MJ/pass.km
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.96E+08	2.20E+08	2.48E+08	MJ/pass.km	5.08E+00	4.93E+00	4.41E+00	3.39E+00	2.90E+00	MJ/pass.km
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.62E+00	4.06E+00	3.75E+00	MJ/pass.km
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.55E+00	1.32E+00	1.19E+00	MJ/pass.km
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	MJ/pass.km
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01	MJ/pass.km
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	MJ/pass.km
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	MJ/pass.km
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	MJ/pass.km
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	MJ/pass.km
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	MJ/pass.km
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01	MJ/pass.km
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07	MJ/pass.km
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	MJ/pass.km
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	MJ/pass.km
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	MJ/pass.km
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.40E-01	4.27E-01	4.14E-01	MJ/pass.km
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01	MJ/pass.km
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.74E+09	4.10E+09	MJ/pass.km	2.11E+00	2.11E+00	2.09E+00	2.05E+00	2.00E+00	MJ/pass.km
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.31E+06	4.73E+06	MJ/pass.km	2.23E+00	2.23E+00	2.21E+00	2.16E+00	2.12E+00	MJ/pass.km
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.92E+06	1.21E+07	2.24E+07	MJ/pass.km	5.92E-01	3.28E+00	1.55E+00	1.88E+00	1.91E+00	MJ/pass.km
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.09E+09	1.97E+09	2.81E+09	MJ/pass.km	3.96E+00	3.74E+00	3.23E+00	2.48E+00	2.16E+00	MJ/pass.km
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	5.04E+10	5.26E+10	5.55E+10	MJ/pass.km	4.58E+00	4.50E+00	4.17E+00	3.13E+00	2.67E+00	MJ/pass.km
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.48E+09	5.04E+09	5.68E+09	MJ/pass.km	5.83E+00	5.74E+00	5.09E+00	3.83E+00	3.21E+00	MJ/pass.km
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+06	1.66E+06	1.88E+06	2.12E+06	2.38E+06	MJ/pass.km	5.01E+00	4.93E+00	4.37E+00	3.29E+00	2.75E+00	MJ/pass.km
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.60E+09	5.00E+09	5.14E+09	5.10E+09	4.78E+09	MJ/pass.km	7.24E+00	7.13E+00	6.51E+00	5.60E+00	5.07E+00	MJ/pass.km
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.32E+08	6.93E+08	8.01E+08	MJ/pass.km	5.66E+00	5.57E+00	5.21E+00	4.38E+00	3.85E+00	MJ/pass.km
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.77E+00	3.24E+00	2.93E+00	MJ/pass.km
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	9.46E+00	7.94E+00	6.99E+00	MJ/pass.km
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	MJ/pass.km
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	MJ/pass.km
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	MJ/pass.km
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	MJ/pass.km
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	MJ/pass.km
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	MJ/pass.km
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	MJ/pass.km
	TOTAL																

Table E.2.2

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 2: Regulatory Instruments

REVISED ENERGY USE — E' (C''D')

SCENARIO EMISSIONS — Strategy

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (MegaJoules) 1988	1990	1995	2000	2005			Tonnes of CO2 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09		tonnes	180 342	187 375	211 120	229 560	252 729	
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09		tonnes	94 572	94 612	106 605	115 920	127 614	
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08		tonnes	6 787	6 790	7 650	8 319	9 158	
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.32E+10	2.52E+10	2.78E+10		tonnes	1 403 880	1 458 577	1 643 415	1 787 019	1 967 305	
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.74E+10	4.00E+10	4.57E+10		tonnes	2 232 781	2 267 014	2 646 560	2 834 638	3 233 856	
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.05E+11	8.44E+10	7.83E+10	6	tonnes	6 683 943	6 960 600	7 124 814	5 735 692	5 325 050	
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	2.03E+09	2.91E+09	3.72E+09		tonnes	48 290	67 438	143 584	205 474	263 122	
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.39E+10	2.07E+10	1.99E+10		tonnes	1 584 182	1 599 428	1 627 911	1 407 789	1 355 960	
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.65E+08	7.47E+08	7.17E+08		tonnes	57 983	60 037	61 108	52 774	50 676	
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.29E+10	4.42E+10	4.68E+10		tonnes	2 793 483	2 820 366	2 918 329	3 006 450	3 180 449	
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.61E+10	5.00E+10	5.17E+10	11	tonnes	2 825 701	2 925 785	3 256 923	3 535 849	3 652 908	
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 184	388 828	454 124	519 900	
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454	
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 060	503 513	
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 888	554 396	626 499	651 106	684 243	
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.39E+09	1.46E+09	1.55E+09		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09		tonnes	68 125	69 660	74 944	78 076	82 094	
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.21E+09	7.66E+09	8.21E+09	26	tonnes	443 056	460 243	509 941	541 484	580 129	
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.72E+06	9.31E+06	1.00E+07		tonnes	511	532	593	633	680	
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.07E+06	2.27E+07	4.27E+07		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.51E+09	4.89E+09	6.07E+09		tonnes	83 829	118 817	248 150	345 774	429 212	
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	2.10E+11	1.65E+11	1.48E+11		tonnes	13 241 454	14 118 327	14 271 757	11 196 725	10 065 842	
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.28E+10	1.93E+10	1.82E+10	31	tonnes	1 493 131	1 536 705	1 548 431	1 312 004	1 237 646	
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	8.22E+08	6.96E+08	6.54E+08		tonnes	46 205	57 682	58 124	49 183	46 254	
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.35E+10	2.85E+10	2.42E+10		tonnes	2 363 984	2 424 810	2 276 785	1 939 737	1 647 455	
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.77E+09	3.03E+09	3.09E+09		tonnes	105 714	130 850	195 929	214 405	218 287	
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.19E+10	9.48E+09	7.46E+09		tonnes	878 445	884 666	808 947	644 279	507 414	
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.67E+10	2.68E+10	2.71E+10	36	tonnes	1 717 010	1 775 824	1 889 124	1 892 161	1 913 040	
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 498	95 000	102 338	115 173	
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 182	167 148	192 469	207 351	233 355	
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.08E+09	6.52E+09	7.34E+09		tonnes	363 667	372 563	428 995	462 166	520 114	
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 308	74 106	
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 406	96 592	94 580	92 609	90 685	
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811	
	TOTAL					0 6.15E+11	6.41E+11	6.70E+11	6.11E+11	6.04E+11			42 281 126	44 033 769	46 100 270	42 110 982	41 684 314	0
						RELATIVE TO 1988 ENERGY USE		109.0%	99.3%	98.1%		RELATIVE TO 1988 EMISSIONS			109.0%	99.6%	98.6%	

Table E.2.2

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005	Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	341	371	409	tonnes	3 668	3 811	4 293	4 668	5 140
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	690	750	826	tonnes	5 436	4 502	3 731	2 599	2 696
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	50	54	59	tonnes	916	830	848	826	896
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	80	87	96	tonnes	669	695	783	852	938
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	129	139	158	tonnes	1 064	1 081	1 261	1 351	1 541
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 278	1 834	1 703	tonnes	62 626	42 841	35 423	24 770	25 111
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	303	433	555	tonnes	676	889	1 924	3 070	4 440
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	521	450	434	tonnes	8 717	6 069	5 592	4 824	5 063
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	129	111	107	tonnes	208	197	199	196	223
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	933	961	1 017	tonnes	1 099	1 026	1 053	1 106	1 251
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 864	7 452	7 696	tonnes	52 850	46 690	43 595	35 429	38 307
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280	tonnes	21 125	21 078	23 694	26 278	28 676
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 538	tonnes	3 132	3 370	4 409	5 149	5 895
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307	tonnes	651	619	576	690	810
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814	tonnes	8 070	8 183	8 618	9 539	10 240
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025	tonnes	5 895	6 296	7 104	7 383	7 758
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	121	126	133	tonnes	1 385	1 417	1 524	1 588	1 670
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 300	3 504	3 754	tonnes	10 489	9 019	7 425	5 155	5 313
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4	tonnes	28	27	27	27	29
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	523	729	905	tonnes	387	512	1 103	1 756	2 531
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 564	3 581	3 219	tonnes	83 703	58 114	47 630	33 113	33 275
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	495	420	396	tonnes	8 253	5 831	5 373	4 635	4 884
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	122	104	97	tonnes	168	189	191	188	214
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	728	620	527	tonnes	14 065	10 003	9 255	8 157	7 224
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	413	452	460	tonnes	341	379	540	617	721
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	259	206	162	tonnes	426	395	358	297	255
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 981	3 988	4 032	tonnes	5 666	4 944	4 130	3 158	3 419
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6	tonnes	38	39	45	49	55
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11	tonnes	73	74	86	92	104
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25	tonnes	173	176	204	220	248
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53	tonnes	770	520	458	359	401
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30	tonnes	668	601	533	468	451
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203	tonnes	3 160	2 297	2 420	2 518	2 782
	TOTAL				0	32 842	33 889	36 429	37 301	39 042	0	0	306 597	242 704	224 407	191 130	202 582	0

Table E.2.2

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	206	227	250		tonnes	198	206	232	252	277	
2	Inter-city	Public	Bus	Diesel	tonnes	567	425	438	432	466		tonnes	292	292	329	357	393	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	609	549	583		tonnes	136	136	153	167	184	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	898	974	1 072		tonnes	56	58	65	71	78	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	105	112	128	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	51 728	40 497	41 434		tonnes	10 809	11 560	12 745	13 368	14 230	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	607	1 035	1 529		tonnes	236	351	853	1 552	2 220	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 946	6 607	7 034		tonnes	1 353	1 394	1 584	1 783	2 010	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	63	66	77		tonnes	73	78	88	99	111	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 418	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344		tonnes	182	196	256	299	342	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70		tonnes	179	170	158	189	222	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769		tonnes	342	365	412	429	450	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	74	77	81		tonnes	75	76	82	86	90	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	872	858	919		tonnes	563	584	654	709	775	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	20	18	19		tonnes	4	4	5	5	6	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	348	592	872		tonnes	135	202	489	868	1 265	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	69 555	54 137	54 905		tonnes	14 446	15 681	17 137	17 871	18 856	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 634	6 348	6 758		tonnes	1 281	1 339	1 522	1 713	1 931	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	60	63	74		tonnes	59	75	85	95	107	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 594	6 679	5 933		tonnes	1 632	1 700	1 748	1 733	1 627	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	170	208	248		tonnes	119	150	239	312	361	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166		tonnes	63	65	65	60	52	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	465	525	591		tonnes	304	320	364	434	499	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63		tonnes	3	3	4	4	5	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119		tonnes	6	6	7	8	9	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284		tonnes	14	15	17	18	21	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661		tonnes	133	142	166	194	227	
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293		tonnes	99	98	96	94	92	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284		tonnes	367	391	457	535	626	
	TOTAL					0 241 480	190 347	171 004	134 752	139 229	0		0 37 820	40 520	45 892	50 466	55 143	0

Table E.2.2

SCENARIO EMISSIONS

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 486	1 524	1 717	1 867	2 055	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 244	2 299	2 511	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 946	4 373	4 412	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 503	2 722	2 997	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	4 032	4 318	4 926	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	378 217	301 168	313 055	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 459	2 553	3 750	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	66 199	57 839	62 242	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	136	151	163	188	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 506	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 506	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	609	635	668	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 466	4 560	4 950	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	192	141	142	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	837	1 460	2 137	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 036	577 447	508 555	402 613	414 834	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	63 603	55 571	59 801	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	145	157	181	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	78 974	60 772	54 446	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	268	409	513	609	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 738	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	16 761	20 965	
	TOTAL				0	1 895 797	1 344 440	1 207 056	991 709	1 031 039	0

E.2.3 Strategy 3: Combined instruments

Measures applied:

- Subsidies/incentives for public transit — medium
  → increase transit mode split to 16 per cent
  → reduce urban passenger vehicle travel 8 per cent
- New CAFE standards — medium
  → reduce passenger vehicle fuel consumption 26 per cent
  → reduce truck fuel consumption 13 per cent
- Urban traffic management — low
  → reduce urban fuel consumption 5 per cent
- Passenger vehicle travel restrictions
  → reduce urban passenger vehicle travel 10 per cent

Table E.2.3

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 3: Combined Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.96	0.80	0.74
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.96	0.80	0.74
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.96	0.80	0.74
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.96	0.80	0.74
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.90	0.87
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.90	0.87
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	0.99	0.97	0.95	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.97	0.93	0.87	1.00	1.00	0.95	0.78	0.70
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.97	0.93	0.87	1.00	1.00	0.95	0.78	0.70
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.97	0.93	0.87	1.00	1.00	0.95	0.78	0.70
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.97	0.93	0.87	1.00	1.00	0.95	0.78	0.70
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.97	0.87	0.83
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.99	0.97	0.95	1.00	1.00	0.97	0.87	0.83
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.87	0.83
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.87	0.83
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.2.3

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 3: Combined Instruments

						CHANGE IN TRANSPORTATION DEMAND C' (ΓC)						CHANGE IN EFFICIENCY D' (Π'D)					
						Revised Vehicle Demand						Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00	
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01	
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01	
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00	
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03	
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.75E+10	3.93E+10	4.19E+10	MJ/pass.km	3.09E+00	3.01E+00	2.82E+00	2.21E+00	1.97E+00	
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.90E+09	3.45E+09	4.93E+09	MJ/pass.km	1.30E+00	1.22E+00	1.08E+00	8.69E-01	7.94E-01	
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.66E+09	5.24E+09	5.91E+09	MJ/pass.km	5.85E+00	5.74E+00	5.19E+00	4.07E+00	3.55E+00	
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.96E+08	2.20E+08	2.48E+08	MJ/pass.km	5.08E+00	4.93E+00	4.46E+00	3.50E+00	3.05E+00	
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.67E+00	4.18E+00	3.94E+00	
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.56E+00	1.36E+00	1.25E+00	
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01	
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01	
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07	
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.40E-01	4.27E-01	4.14E-01	
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01	
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.74E+09	4.10E+09	MJ/pass.km	2.11E+00	2.11E+00	2.09E+00	2.05E+00	2.00E+00	
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.31E+06	4.73E+06	MJ/pass.km	2.23E+00	2.23E+00	2.21E+00	2.16E+00	2.12E+00	
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.92E+06	1.21E+07	2.24E+07	MJ/pass.km	5.92E-01	3.28E+00	1.56E+00	1.94E+00	2.01E+00	
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.07E+09	1.89E+09	2.59E+09	MJ/pass.km	3.96E+00	3.74E+00	3.26E+00	2.56E+00	2.27E+00	
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.94E+10	5.05E+10	5.10E+10	MJ/pass.km	4.58E+00	4.50E+00	4.21E+00	3.23E+00	2.81E+00	
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.39E+09	4.84E+09	5.22E+09	MJ/pass.km	5.83E+00	5.74E+00	5.14E+00	3.95E+00	3.37E+00	
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.84E+08	2.03E+08	2.19E+08	MJ/pass.km	5.01E+00	4.93E+00	4.41E+00	3.39E+00	2.90E+00	
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.14E+09	5.10E+09	4.78E+09	MJ/pass.km	7.24E+00	7.13E+00	6.58E+00	5.77E+00	5.33E+00	
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.32E+08	6.93E+08	8.01E+08	MJ/pass.km	5.66E+00	5.57E+00	5.26E+00	4.51E+00	4.06E+00	
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.81E+00	3.34E+00	3.08E+00	
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	9.56E+00	8.19E+00	7.35E+00	
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
	TOTAL																

Table E.2.3

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 3: Combined Instruments

REVISED ENERGY USE — E' (C''D')

SCENARIO EMISSIONS — Strategy Tonnes of CO2

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (MegaJoules) 1988	1990	1995	2000	2005			Strategy Tonnes of CO2 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09		tonnes	180 342	187 375	211 120	229 560	252 729	
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09		tonnes	94 572	94 612	106 605	115 920	127 614	
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08		tonnes	6 787	6 790	7 650	8 319	9 158	
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.32E+10	2.52E+10	2.78E+10		tonnes	1 403 880	1 458 577	1 643 415	1 787 019	1 967 305	
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.74E+10	4.00E+10	4.57E+10		tonnes	2 232 781	2 267 014	2 646 560	2 834 638	3 233 856	
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.06E+11	8.70E+10	8.25E+10	6	tonnes	6 683 943	6 960 600	7 196 782	5 913 084	5 605 316	
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	2.05E+09	3.00E+09	3.92E+09		tonnes	48 290	67 438	145 034	211 829	276 971	
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.42E+10	2.14E+10	2.10E+10		tonnes	1 584 182	1 599 428	1 644 355	1 451 329	1 427 327	
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.73E+08	7.70E+08	7.55E+08		tonnes	57 983	60 037	61 725	54 406	53 343	
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.34E+10	4.56E+10	4.93E+10		tonnes	2 793 483	2 820 366	2 947 807	3 099 433	3 347 841	
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.65E+10	5.16E+10	5.44E+10	11	tonnes	2 825 701	2 925 785	3 289 821	3 645 205	3 845 166	
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 036 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 184	388 828	454 124	519 900	
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454	
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 080	503 513	
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 888	554 396	626 499	651 106	684 243	
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.39E+09	1.46E+09	1.55E+09		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09		tonnes	68 125	69 660	74 944	78 076	82 094	
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.21E+09	7.66E+09	8.21E+09	26	tonnes	443 056	460 243	509 941	541 484	580 129	
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.72E+06	9.31E+06	1.00E+07		tonnes	511	532	593	633	680	
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.13E+06	2.34E+07	4.49E+07		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.48E+09	4.84E+09	5.86E+09		tonnes	83 829	118 817	245 644	342 209	415 658	
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	2.08E+11	1.63E+11	1.43E+11		tonnes	13 241 454	14 118 327	14 127 598	11 081 295	9 747 973	
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.25E+10	1.91E+10	1.76E+10	31	tonnes	1 493 131	1 536 705	1 532 790	1 298 479	1 198 563	
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	8.14E+08	6.89E+08	6.34E+08		tonnes	46 205	57 682	57 537	48 676	44 794	
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.38E+10	2.94E+10	2.55E+10		tonnes	2 363 984	2 424 810	2 299 783	1 999 729	1 734 163	
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.80E+09	3.13E+09	3.25E+09		tonnes	105 714	130 850	197 908	221 036	229 776	
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.20E+10	9.77E+09	7.86E+09		tonnes	878 445	884 686	817 119	664 205	534 120	
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.70E+10	2.76E+10	2.85E+10	36	tonnes	1 717 010	1 775 824	1 908 206	1 950 682	2 013 726	
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 498	95 000	102 338	115 173	
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 162	167 148	192 469	207 351	233 355	
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09		tonnes	363 667	372 583	428 995	462 166	520 114	
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 306	74 106	
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 408	96 592	94 560	92 609	90 685	
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811	
	TOTAL				0	6.15E+11	6.41E+11	6.71E+11	6.17E+11	6.12E+11			42 261 126	44 033 769	46 142 462	42 554 283	42 265 735	0
						RELATIVE TO 1988 ENERGY USE		109.1%	100.3%	99.5%		RELATIVE TO 1988 EMISSIONS			109.1%	100.6%	100.0%	

Table E.2.3

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 3: Combined Instruments

SCENARIO EMISSIONS

SCENARIO EMISSIONS

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005	Units	Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	341	371	409	tonnes	3 668	3 811	4 293	4 668	5 140
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	690	750	826	tonnes	5 436	4 502	3 731	2 599	2 696
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	50	54	59	tonnes	916	830	846	826	896
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	80	87	96	tonnes	669	695	783	852	938
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	129	139	158	tonnes	1 064	1 081	1 261	1 351	1 541
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 301	1 891	1 792	tonnes	62 626	42 841	35 423	24 770	25 111
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	306	446	584	tonnes	678	889	1 924	3 070	4 440
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	526	464	456	tonnes	8 717	6 069	5 592	4 824	5 083
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	130	115	112	tonnes	206	197	199	196	223
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	943	991	1 071	tonnes	1 099	1 026	1 053	1 106	1 251
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 933	7 682	8 104	tonnes	52 850	46 690	43 595	35 429	38 307
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280	tonnes	21 125	21 078	23 694	26 278	28 676
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 538	tonnes	3 132	3 370	4 409	5 149	5 895
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307	tonnes	651	619	576	690	810
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814	tonnes	8 070	8 183	8 618	9 539	10 240
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025	tonnes	5 895	6 286	7 104	7 383	7 758
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	121	126	133	tonnes	1 385	1 417	1 524	1 588	1 670
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 300	3 504	3 754	tonnes	10 489	9 019	7 425	5 155	5 313
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4	tonnes	28	27	27	27	29
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	518	721	876	tonnes	387	512	1 081	1 686	2 328
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 518	3 544	3 117	tonnes	83 703	58 114	46 677	31 789	30 613
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	490	415	383	tonnes	8 253	5 831	5 266	4 450	4 493
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	121	103	94	tonnes	168	189	187	181	197
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	735	639	555	tonnes	14 065	10 003	9 255	8 157	7 224
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	417	466	484	tonnes	341	379	540	617	721
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	261	212	171	tonnes	426	395	358	297	255
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	4 021	4 111	4 244	tonnes	5 666	4 944	4 130	3 158	3 419
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6	tonnes	38	39	45	49	55
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11	tonnes	73	74	86	92	104
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25	tonnes	173	178	204	220	248
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53	tonnes	770	520	456	359	401
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30	tonnes	668	601	533	468	451
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203	tonnes	3 160	2 297	2 420	2 518	2 782
	TOTAL				0	32 842	33 889	36 537	37 762	39 775	0	0	306 597	242 704	223 321	189 543	199 309	0

Table E.2.3

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	208	227	250		tonnes	196	206	232	252	277	
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	438	432	466		tonnes	292	292	329	357	393	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	609	549	583		tonnes	136	136	153	167	184	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	896	974	1 072		tonnes	56	58	65	71	78	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	105	112	128	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	51 728	40 497	41 434		tonnes	10 809	11 560	12 745	13 368	14 230	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	607	1 035	1 529		tonnes	236	351	853	1 552	2 220	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 946	5 507	7 034		tonnes	1 353	1 394	1 584	1 783	2 010	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	63	66	77		tonnes	73	78	88	99	111	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 418	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344		tonnes	182	196	256	299	342	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70		tonnes	179	170	158	189	222	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769		tonnes	342	365	412	429	450	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	74	77	81		tonnes	75	76	82	86	90	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	872	858	919		tonnes	563	584	654	709	775	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	20	18	19		tonnes	4	4	5	5	6	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	341	568	802		tonnes	135	202	479	852	1 164	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	68 164	51 972	50 512		tonnes	14 446	15 681	16 794	17 156	17 348	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 481	6 094	6 217		tonnes	1 281	1 339	1 492	1 644	1 776	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	59	61	68		tonnes	59	75	83	91	98	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 594	6 679	5 933		tonnes	1 632	1 700	1 748	1 733	1 627	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	170	208	248		tonnes	119	150	239	312	361	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166		tonnes	63	65	65	60	52	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591		tonnes	304	320	364	434	499	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63		tonnes	3	3	4	4	5	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	96	105	119		tonnes	6	6	7	8	9	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284		tonnes	14	15	17	18	21	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661		tonnes	133	142	166	194	227	
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293		tonnes	99	96	96	94	92	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284		tonnes	367	381	457	535	626	
	TOTAL				0	241 480	190 347	169 452	132 307	134 220	0	0	37 820	40 520	45 507	49 644	53 370	0

Table E.2.3

Scenario 2: Zero per cent increase in CO2 emissions relative to 1988 by 2000

Strategy 3: Combined Instruments

SCENARIO EMISSIONS

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 717	1 867	2 055	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 244	2 299	2 511	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 946	4 373	4 412	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 503	2 722	2 997	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	4 032	4 318	4 926	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	378 217	301 168	313 055	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 459	2 553	3 750	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	66 199	57 839	62 242	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	151	163	188	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 508	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	609	635	668	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 466	4 560	4 950	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	192	141	142	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	820	1 402	1 966	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	498 384	386 508	381 647	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	62 330	53 348	55 017	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	142	150	166	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	78 974	60 772	54 446	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	409	513	609	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 738	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	18 761	20 965	
	TOTAL				0	1 895 797	1 344 440	1 195 593	973 317	992 883	0

Appendix E.3 Scenario 3: Twenty per cent reduction in CO_2 emissions relative to 1988 by 2005 at least cost

E.3.1 Scenario 1: Economic instruments

Measures applied:

- Carbon tax for 20% reduction → reduce fuel consumption 38 per cent
- Carbon tax — medium → reduce passenger vehicle travel 5 per cent

Table E.3.1

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 1: Economic Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS					CHANGE IN EFFICIENCY COEFFICIENTS				
					I.					II.				
					Vehicle Demand					Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.98	0.95	1.00	1.00	0.90	0.77	0.62
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.98	0.95	1.00	1.00	0.90	0.77	0.62
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.98	0.95	1.00	1.00	0.90	0.77	0.62
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.98	0.95	1.00	1.00	0.90	0.77	0.62
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.96	0.92	0.82	1.00	1.00	0.90	0.77	0.62
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.96	0.92	0.82	1.00	1.00	0.90	0.77	0.62
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.96	0.92	0.82	1.00	1.00	0.90	0.77	0.62
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.96	0.92	0.82	1.00	1.00	0.90	0.77	0.62
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
	TOTAL													

Table E.3.1

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 1: Economic Instruments

						CHANGE IN TRANSPORTATION DEMAND C' (I'C)						CHANGE IN EFFICIENCY D' (II'D)				
						Revised Vehicle Demand						Revised Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.59E+00	4.59E+00	4.13E+00	3.54E+00	2.82E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6.38E+03	6.38E+03	5.75E+03	4.92E+03	3.93E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.75E+10	3.97E+10	4.19E+10	MJ/pass.km	3.09E+00	3.01E+00	2.65E+00	2.13E+00	1.64E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.90E+09	3.48E+09	4.93E+09	MJ/pass.km	1.30E+00	1.22E+00	1.01E+00	8.36E-01	6.60E-01
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.66E+09	5.30E+09	5.91E+09	MJ/pass.km	5.85E+00	5.74E+00	4.87E+00	3.92E+00	2.95E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.96E+08	2.22E+08	2.48E+08	MJ/pass.km	5.08E+00	4.93E+00	4.18E+00	3.37E+00	2.53E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.29E+00	3.58E+00	2.79E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.43E+00	1.17E+00	8.86E-01
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.66E-01	1.39E-01	1.08E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	1.98E-01	1.65E-01	1.29E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	2.70E-07	2.31E-07	1.85E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.20E-07	6.16E-07	4.92E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.20E-07	6.16E-07	4.92E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.20E-07	6.16E-07	4.92E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.45E-01	4.41E-01	4.36E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.74E+09	4.10E+09	MJ/pass.km	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.31E+06	4.73E+06	MJ/pass.km	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.96E+06	1.25E+07	2.35E+07	MJ/pass.km	5.92E-01	3.26E+00	1.56E+00	1.94E+00	2.01E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.05E+09	1.87E+09	2.42E+09	MJ/pass.km	3.96E+00	3.74E+00	3.09E+00	2.54E+00	1.99E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.69E+10	4.99E+10	4.77E+10	MJ/pass.km	4.58E+00	4.50E+00	3.98E+00	3.21E+00	2.46E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.34E+09	4.78E+09	4.88E+09	MJ/pass.km	5.83E+00	5.74E+00	4.87E+00	3.92E+00	2.95E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.83E+08	2.01E+08	2.05E+08	MJ/pass.km	5.01E+00	4.93E+00	4.18E+00	3.37E+00	2.53E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	MJ/pass.km	7.24E+00	7.13E+00	6.10E+00	5.09E+00	3.97E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	MJ/pass.km	5.66E+00	5.57E+00	4.88E+00	3.98E+00	3.02E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.53E+00	2.95E+00	2.29E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	8.87E+00	7.22E+00	5.47E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
	TOTAL															

Table E.3.1

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 1: Economic Instruments

REVISED ENERGY USE — E' (C"D')

Strategy Energy Use (MegaJoules)

SCENARIO EMISSIONS — Strategy — Tonnes of CO2

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005			1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09		tonnes	180 342	187 375	211 120	229 560	252 729	
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09		tonnes	94 572	94 612	106 605	115 920	127 614	
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08		tonnes	6 787	6 790	7 650	8 319	9 158	
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.09E+10	1.94E+10	1.71E+10		tonnes	1 403 880	1 458 577	1 479 074	1 376 005	1 209 893	
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.36E+10	3.08E+10	2.81E+10		tonnes	2 232 781	2 267 014	2 381 904	2 182 671	1 988 821	
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	9.93E+10	8.46E+10	6.85E+10	6	tonnes	6 683 943	6 960 600	6 746 983	5 750 017	4 658 472	
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	1.92E+09	2.91E+09	3.26E+09		tonnes	48 290	67 436	135 970	205 988	230 185	
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.27E+10	2.08E+10	1.75E+10		tonnes	1 584 182	1 599 428	1 541 583	1 411 305	1 186 224	
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.19E+08	7.48E+08	6.27E+08		tonnes	57 983	60 037	57 867	52 906	44 333	
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	3.98E+10	3.90E+10	3.48E+10		tonnes	2 793 483	2 820 366	2 707 170	2 651 737	2 366 577	
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.27E+10	4.41E+10	3.85E+10	11	tonnes	2 825 701	2 925 785	3 021 265	3 118 675	2 718 135	
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	4.95E+09	4.95E+09	4.52E+09		tonnes	276 181	297 184	349 945	349 675	319 738	
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	4.95E+09	5.07E+09	4.75E+09		tonnes	501 341	476 603	399 130	408 945	383 424	
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 080	503 513	
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	7.98E+09	7.09E+09	5.95E+09		tonnes	519 888	554 396	563 849	501 351	420 809	
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	4.67E+03	4.26E+03	3.66E+03		tonnes	1	1	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.40E+09	1.50E+09	1.63E+09		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09		tonnes	68 125	69 660	74 944	78 076	82 094	
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.29E+09	7.90E+09	8.64E+09	26	tonnes	443 056	460 243	515 091	558 231	610 662	
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.81E+06	9.59E+06	1.05E+07		tonnes	511	532	599	652	716	
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.19E+06	2.42E+07	4.73E+07		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.26E+09	4.75E+09	4.81E+09		tonnes	83 829	118 817	230 244	335 917	339 912	
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	1.95E+11	1.60E+11	1.17E+11		tonnes	13 241 454	14 118 327	13 241 893	10 877 535	7 971 586	
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.11E+10	1.88E+10	1.44E+10	31	tonnes	1 493 131	1 536 705	1 436 695	1 274 603	980 147	
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	7.63E+08	6.76E+08	5.18E+08		tonnes	46 205	57 682	53 930	47 781	36 631	
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.17E+10	2.68E+10	2.00E+10		tonnes	2 363 984	2 424 810	2 154 928	1 818 343	1 358 309	
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.62E+09	2.84E+09	2.55E+09		tonnes	105 714	130 850	185 443	200 987	179 975	
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.12E+10	8.62E+09	5.85E+09		tonnes	878 445	884 666	757 995	585 839	397 440	
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.50E+10	2.43E+10	2.12E+10	36	tonnes	1 717 010	1 775 824	1 770 135	1 720 533	1 498 417	
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.21E+09	1.11E+09	1.00E+09		tonnes	80 529	82 498	85 500	78 801	70 831	
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.28E+09	2.10E+09	1.89E+09		tonnes	163 162	167 148	173 222	159 660	143 513	
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	5.45E+09	5.02E+09	4.52E+09		tonnes	363 667	372 563	386 096	355 868	319 870	
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.16E+08	7.17E+08	6.70E+08	41	tonnes	43 381	46 202	48 675	48 747	45 575	
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.25E+09	1.05E+09	8.20E+08		tonnes	97 408	96 592	85 122	71 309	55 771	
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	7.37E+09	7.38E+09	6.90E+09		tonnes	446 559	475 591	501 047	501 793	469 129	
	TOTAL					0 6.15E+11	6.41E+11	6.25E+11	5.64E+11	4.70E+11			42 281 126	44 033 769	43 000 546	38 839 007	32 390 284	0
						RELATIVE TO 1988 ENERGY USE		101.7%	91.7%	76.4%		RELATIVE TO 1988 EMISSIONS			101.7%	91.9%	76.6%	

Table E.3.1

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	341	371	409		tonnes	3 668	3 811	4 293	4 668	5 140	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	690	750	826		tonnes	5 436	4 502	3 731	2 599	2 696	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	50	54	59		tonnes	916	830	848	826	896	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	72	67	59		tonnes	669	695	705	656	577	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	116	107	97		tonnes	1 064	1 081	1 135	1 040	948	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 158	1 839	1 490		tonnes	62 626	42 841	35 423	25 025	25 111	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	287	434	485		tonnes	676	889	1 924	3 102	4 440	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	493	451	379		tonnes	8 717	6 069	5 592	4 874	5 083	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	122	111	93		tonnes	208	197	199	198	223	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	866	848	757		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 367	6 573	5 728		tonnes	52 850	46 690	43 595	35 429	38 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280		tonnes	21 125	21 078	23 694	26 278	28 676	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 035	1 035	946		tonnes	3 132	3 370	3 968	3 965	3 625	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 398	3 481	3 264		tonnes	651	619	518	531	498	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 536	1 640	1 668	1 484	1 245		tonnes	5 895	6 286	6 393	5 685	4 771	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	121	126	133		tonnes	1 385	1 417	1 524	1 588	1 670	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 333	3 612	3 952		tonnes	10 489	9 019	7 425	5 155	5 313	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	5		tonnes	28	27	27	27	29	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	485	708	716		tonnes	367	512	1 070	1 668	2 178	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 235	3 478	2 549		tonnes	83 703	58 114	46 201	31 447	28 617	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	459	408	313		tonnes	8 253	5 831	5 212	4 402	4 200	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	114	101	77		tonnes	168	189	185	179	184	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	689	561	434		tonnes	14 065	10 003	9 348	8 410	7 605	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	391	424	379		tonnes	341	379	545	636	759	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	242	187	127		tonnes	426	395	358	297	255	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 731	3 626	3 158		tonnes	5 666	4 944	4 130	3 158	3 419	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	4	4	3		tonnes	36	39	41	38	34	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	6	7	7		tonnes	73	74	77	71	64	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	19	17	16		tonnes	173	178	184	170	152	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	35	35	33		tonnes	770	520	412	277	246	
42	Other	Other	School bus	Gasoline	tonnes	32	32	28	24	18		tonnes	668	601	480	360	277	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	133	133	125		tonnes	3 160	2 297	2 178	1 939	1 711	
	TOTAL					0 32 842	33 869	34 263	33 929	30 977	0	0	306 597	242 704	221 089	185 343	189 195	0

Table E.3.1

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005	Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	208	227	250	tonnes	198	206	232	252	277
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	438	432	466	tonnes	292	292	329	357	393
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	609	549	583	tonnes	136	136	153	167	184
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	806	750	660	tonnes	56	58	59	55	48
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0	tonnes	89	90	94	87	79
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	56 822	51 728	40 914	41 434	tonnes	10 809	11 560	12 745	13 506	14 230
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	607	1 045	1 529	tonnes	236	351	853	1 568	2 220
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 946	6 675	7 034	tonnes	1 353	1 394	1 584	1 801	2 010
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	63	67	77	tonnes	73	78	88	100	111
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814	tonnes	163	168	190	224	256
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626	tonnes	2 835	3 025	3 840	4 872	5 591
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393	tonnes	1 140	1 137	1 278	1 418	1 547
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	905	904	827	tonnes	182	196	230	230	211
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	45	46	43	tonnes	179	170	142	146	137
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497	tonnes	435	442	465	515	553
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 458	1 296	1 088	tonnes	342	365	371	330	277
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	74	77	81	tonnes	75	76	82	86	90
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	872	858	919	tonnes	563	584	654	709	775
27	Urban	Public	Bus	Gasoline	tonnes	34	20	20	18	19	tonnes	4	4	5	5	6
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	337	562	750	tonnes	135	202	474	843	1 088
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	67 468	51 414	47 218	tonnes	14 446	15 681	16 623	16 971	16 216
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 405	6 029	5 812	tonnes	1 281	1 339	1 477	1 627	1 661
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	58	60	63	tonnes	59	75	82	90	92
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 711	6 885	6 245	tonnes	1 632	1 700	1 766	1 787	1 712
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	172	214	262	tonnes	119	150	242	321	380
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166	tonnes	63	65	65	60	52
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591	tonnes	304	320	364	434	499
37	Aviation	General	Airplane	Turbo	tonnes	44	45	47	43	39	tonnes	3	3	3	3	3
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	88	81	73	tonnes	6	6	6	6	5
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	210	194	174	tonnes	14	15	15	14	13
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	884	452	407	tonnes	133	142	149	149	140
42	Other	Other	School bus	Gasoline	tonnes	792	457	548	239	180	tonnes	99	98	87	73	57
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	4 810	1 588	1 405	tonnes	367	391	411	412	385
	TOTAL				0	241 480	190 347	167 706	130 715	127 724	0	0	37 820	40 520	45 161	49 219	51 298	0

Table E.3.1

SCENARIO EMISSIONS

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 717	1 867	2 055	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 244	2 299	2 511	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 946	4 373	4 412	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 253	2 096	1 843	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	3 628	3 325	3 030	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	378 217	304 273	313 055	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 459	2 579	3 750	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	66 199	58 436	62 242	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	151	165	188	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 688	1 687	1 543	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	2 720	2 419	2 030	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	609	635	668	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 466	4 560	4 950	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	192	141	142	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	812	1 387	1 836	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	493 298	382 358	356 757	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	61 694	52 775	51 429	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	141	149	155	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	79 771	62 652	57 312	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	414	529	641	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	130	120	108	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	246	227	204	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	588	542	487	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 426	3 365	3 072	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 364	1 906	1 366	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	18 587	14 446	12 894	
	TOTAL					0 1 895 797	1 344 440	1 186 483	965 200	950 526	0

E.3.2 Scenario 2: Regulatory instruments

Measures applied:

• New CAFE standards — high	→ reduce passenger vehicle fuel consumption 32 per cent → reduce truck fuel consumption 14 per cent
• Urban land use management — low	→ reduce passenger vehicle travel by 10 per cent
• Urban traffic management — low	→ reduce urban fuel consumption 5 per cent
• Inspection and maintenance programs	→ reduce passenger vehicle fuel consumption 5 per cent
• Passenger vehicle travel restrictions	→ reduce passenger vehicle travel 30 per cent

Table E.3.2

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 2: Regulatory Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.97	0.70	1.00	1.00	0.94	0.73	0.65
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.97	0.70	1.00	1.00	0.94	0.73	0.65
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.97	0.70	1.00	1.00	0.94	0.73	0.65
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.97	0.70	1.00	1.00	0.94	0.73	0.65
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	1.00	0.98	0.90	1.00	1.00	0.99	0.97	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	1.00	0.98	0.90	1.00	1.00	0.99	0.97	0.95
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	0.99	0.97	0.70	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.99	0.95	0.63	1.00	1.00	0.93	0.71	0.61
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.99	0.95	0.63	1.00	1.00	0.93	0.71	0.61
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.99	0.95	0.63	1.00	1.00	0.93	0.71	0.61
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.99	0.95	0.63	1.00	1.00	0.93	0.71	0.61
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.99	0.95	0.63	1.00	1.00	0.96	0.83	0.78
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.99	0.95	0.63	1.00	1.00	0.96	0.83	0.78
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	0.98	0.90	1.00	1.00	0.96	0.83	0.78
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	0.98	0.90	1.00	1.00	0.96	0.83	0.78
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.3.2

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 2: Regulatory Instruments

						CHANGE IN TRANSPORTATION DEMAND			C' (I'C)			CHANGE IN EFFICIENCY			D' (II'D)		
						Revised Vehicle Demand						Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00	
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01	
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01	
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00	
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03	
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.75E+10	3.93E+10	3.08E+10	MJ/pass.km	3.09E+00	3.01E+00	2.77E+00	2.01E+00	1.72E+00	
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.90E+09	3.45E+09	3.64E+09	MJ/pass.km	1.30E+00	1.22E+00	1.06E+00	7.90E-01	6.93E-01	
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.66E+09	5.24E+09	4.36E+09	MJ/pass.km	5.85E+00	5.74E+00	5.09E+00	3.70E+00	3.10E+00	
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.96E+08	2.20E+08	1.82E+08	MJ/pass.km	5.08E+00	4.93E+00	4.37E+00	3.18E+00	2.66E+00	
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.62E+00	3.97E+00	3.70E+00	
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.55E+00	1.29E+00	1.18E+00	
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.06E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01	
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01	
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01	
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01	
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07	
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07	
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.40E-01	4.27E-01	4.14E-01	
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01	
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.45E+09	3.67E+09	3.69E+09	MJ/pass.km	2.11E+00	2.11E+00	2.09E+00	2.05E+00	2.00E+00	
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.95E+06	4.22E+06	4.25E+06	MJ/pass.km	2.23E+00	2.23E+00	2.21E+00	2.16E+00	2.12E+00	
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.92E+06	1.21E+07	1.65E+07	MJ/pass.km	5.92E-01	3.28E+00	1.55E+00	1.88E+00	1.91E+00	
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.09E+09	1.93E+09	1.86E+09	MJ/pass.km	3.96E+00	3.74E+00	3.20E+00	2.32E+00	1.98E+00	
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	5.04E+10	5.15E+10	3.68E+10	MJ/pass.km	4.58E+00	4.50E+00	4.12E+00	2.94E+00	2.45E+00	
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.48E+09	4.94E+09	3.77E+09	MJ/pass.km	5.83E+00	5.74E+00	5.03E+00	3.59E+00	2.95E+00	
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.88E+08	2.07E+08	1.58E+08	MJ/pass.km	5.01E+00	4.93E+00	4.32E+00	3.08E+00	2.53E+00	
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.14E+09	5.00E+09	3.17E+09	MJ/pass.km	7.24E+00	7.13E+00	6.51E+00	5.47E+00	5.01E+00	
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.32E+08	6.79E+08	5.32E+08	MJ/pass.km	5.66E+00	5.57E+00	5.21E+00	4.28E+00	3.81E+00	
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.87E+09	2.29E+09	MJ/pass.km	4.19E+00	4.12E+00	3.77E+00	3.17E+00	2.90E+00	
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.30E+09	3.49E+09	MJ/pass.km	1.03E+01	1.01E+01	9.46E+00	7.77E+00	6.91E+00	
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	
	TOTAL																

Table E.3.2

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 2: Regulatory Instruments

REVISED ENERGY USE — E' (C''D')

SCENARIO EMISSIONS — Strategy Tonnes of CO2

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (MegaJoules) 1988	1990	1995	2000	2005			Strategy Tonnes of CO2 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09		tonnes	180 342	187 375	211 120	229 560	252 729
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09		tonnes	94 572	94 612	106 605	115 920	127 614
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08		tonnes	6 787	6 790	7 650	8 319	9 158
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.32E+10	2.52E+10	2.78E+10		tonnes	1 403 880	1 458 577	1 643 415	1 787 019	1 967 305
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.74E+10	4.00E+10	4.57E+10		tonnes	2 232 781	2 267 014	2 646 560	2 834 636	3 233 856
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.04E+11	7.91E+10	5.30E+10	6	tonnes	6 683 943	6 960 600	7 050 597	5 377 211	3 605 581
7	Inter-city	Private	Auto	Diesel	MJ/a	6.63E+08	9.54E+08	2.01E+09	2.73E+09	2.52E+09		tonnes	46 290	67 438	142 068	192 632	178 160
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.37E+10	1.94E+10	1.35E+10		tonnes	1 584 182	1 599 428	1 610 954	1 319 803	918 118
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.56E+08	7.00E+08	4.85E+08		tonnes	57 963	60 037	60 471	49 475	34 313
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.29E+10	4.32E+10	4.63E+10		tonnes	2 793 483	2 820 366	2 918 329	2 939 640	3 143 892
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.61E+10	4.89E+10	5.11E+10	11	tonnes	2 825 701	2 925 785	3 256 923	3 457 274	3 610 920
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 184	388 828	454 124	519 900
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 060	503 513
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 888	554 396	626 499	651 106	684 243
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.39E+09	1.46E+09	1.55E+09		tonnes	0	0	0	0	0
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09		tonnes	68 125	69 660	74 944	78 076	82 094
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.21E+09	7.51E+09	7.39E+09	26	tonnes	443 056	460 243	509 941	530 655	522 116
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.72E+06	9.12E+06	9.00E+06		tonnes	511	532	593	620	612
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.07E+06	2.27E+07	3.14E+07		tonnes	0	0	0	0	0
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.47E+09	4.49E+09	3.70E+09		tonnes	83 829	118 817	245 566	317 680	261 557
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	2.08E+11	1.51E+11	9.02E+10		tonnes	13 241 454	14 118 327	14 123 093	10 286 991	6 134 007
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.25E+10	1.77E+10	1.11E+10	31	tonnes	1 493 131	1 536 705	1 532 302	1 205 404	754 207
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	8.14E+08	6.39E+08	3.99E+08		tonnes	46 205	57 682	57 519	45 187	28 187
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.35E+10	2.73E+10	1.59E+10		tonnes	2 363 984	2 424 810	2 276 785	1 858 699	1 079 965
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.65E+09	2.77E+09	2.91E+09	2.02E+09		tonnes	105 714	130 850	195 929	205 448	143 095
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.19E+10	9.08E+09	6.64E+09		tonnes	878 445	884 666	808 947	617 362	451 424
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.67E+10	2.57E+10	2.41E+10	36	tonnes	1 717 010	1 775 824	1 889 124	1 813 111	1 701 946
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 498	95 000	102 338	115 173
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 162	167 148	192 489	207 351	233 355
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09		tonnes	363 667	372 563	428 995	462 166	520 114
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 306	74 106
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 406	96 592	94 580	92 609	90 685
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811
	TOTAL					0 6.15E+11	6.41E+11	6.66E+11	5.83E+11	4.88E+11			42 281 126	44 033 769	45 836 980	40 247 761	33 778 289	0
						RELATIVE TO 1988 ENERGY USE		108.3%	94.9%	79.3%		RELATIVE TO 1988 EMISSIONS			108.4%	95.2%	79.9%

Table E.3.2

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	SCENARIO EMISSIONS Units	Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		SCENARIO EMISSIONS Units	Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	341	371	409		tonnes	3 668	3 811	4 293	4 668	5 140	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	690	750	826		tonnes	5 436	4 502	3 731	2 599	2 696	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	50	54	59		tonnes	916	830	848	826	896	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	80	87	96		tonnes	669	695	783	852	938	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	129	139	158		tonnes	1 064	1 081	1 261	1 351	1 541	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 255	1 720	1 153		tonnes	62 626	42 841	35 423	24 770	18 503	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	299	406	375		tonnes	676	889	1 924	3 070	3 272	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	515	422	294		tonnes	8 717	6 069	5 592	4 824	3 746	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	127	104	72		tonnes	208	197	199	196	164	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	933	940	1 005		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 864	7 286	7 610		tonnes	52 850	46 690	43 595	35 429	38 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280		tonnes	21 125	21 078	23 694	26 278	28 676	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 536		tonnes	3 132	3 370	4 409	5 149	5 895	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307		tonnes	651	619	576	690	810	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025		tonnes	5 895	6 286	7 104	7 383	7 758	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	121	126	133		tonnes	1 385	1 417	1 524	1 588	1 670	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 300	3 434	3 379		tonnes	10 489	9 019	7 425	5 052	4 782	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4		tonnes	28	27	27	26	26	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	518	670	551		tonnes	387	512	1 103	1 721	1 678	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 516	3 290	1 962		tonnes	83 703	58 114	47 630	32 451	22 067	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	490	385	241		tonnes	8 253	5 831	5 373	4 542	3 239	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	121	95	59		tonnes	168	189	191	184	142	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	728	594	345		tonnes	14 065	10 003	9 255	7 994	4 791	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	413	433	302		tonnes	341	379	540	604	478	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	259	197	144		tonnes	426	395	358	291	230	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 981	3 821	3 587		tonnes	5 666	4 944	4 130	3 095	3 078	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6		tonnes	38	39	45	49	55	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11		tonnes	73	74	86	92	104	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25		tonnes	173	178	204	220	248	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53		tonnes	770	520	458	359	401	
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30		tonnes	668	601	533	468	451	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203		tonnes	3 160	2 297	2 420	2 516	2 782	
	TOTAL				0	32 842	33 889	36 336	36 254	35 056	0	0	306 597	242 704	224 407	189 988	176 052	0

Table E.3.2

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	206	227	250		tonnes	198	206	232	252	277	
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	438	432	466		tonnes	292	292	329	357	393	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 066	632	609	549	563		tonnes	136	136	153	167	184	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	896	974	1 072		tonnes	56	58	65	71	78	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	105	112	128	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	51 728	40 497	30 530		tonnes	10 809	11 560	12 745	13 368	10 485	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	607	1 035	1 127		tonnes	236	351	853	1 552	1 636	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 946	6 607	5 183		tonnes	1 353	1 394	1 584	1 783	1 481	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	63	66	57		tonnes	73	78	88	99	82	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 418	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344		tonnes	182	196	256	299	342	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70		tonnes	179	170	158	189	222	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769		tonnes	342	365	412	429	450	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	74	77	81		tonnes	75	76	82	86	90	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	872	841	827		tonnes	563	584	654	695	698	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	20	17	17		tonnes	4	4	5	5	5	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	348	560	578		tonnes	135	202	469	870	839	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	69 555	53 054	36 410		tonnes	14 446	15 681	17 137	17 513	12 505	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 634	6 221	4 482		tonnes	1 281	1 339	1 522	1 679	1 280	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	60	62	49		tonnes	59	75	85	93	71	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 594	6 545	3 934		tonnes	1 632	1 700	1 748	1 699	1 079	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	170	204	165		tonnes	119	150	239	306	239	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	194	149		tonnes	63	65	65	59	47	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	515	532		tonnes	304	320	364	426	449	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63		tonnes	3	3	4	4	5	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119		tonnes	6	6	7	8	9	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284		tonnes	14	15	17	18	21	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661		tonnes	133	142	166	194	227	
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293		tonnes	99	98	96	94	92	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284		tonnes	367	391	457	535	626	
	TOTAL				0	241 480	190 347	171 004	133 360	102 711	0	0	37 820	40 520	45 892	49 990	41 989	0

Table E.3.2

SCENARIO EMISSIONS

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 717	1 867	2 055	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 244	2 299	2 511	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 946	4 373	4 412	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 503	2 722	2 997	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	4 032	4 318	4 926	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	378 217	301 168	230 672	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 459	2 553	2 763	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	66 199	57 839	45 862	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	151	163	139	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 508	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	609	635	668	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 466	4 469	4 455	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	192	138	128	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	837	1 431	1 417	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	508 555	394 561	275 100	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	63 603	54 460	39 657	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	145	153	120	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	78 974	59 557	36 106	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	409	502	404	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 542	1 132	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 737	2 867	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 738	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	18 761	20 965	
	TOTAL				0	1 895 797	1 344 440	1 207 056	981 106	751 085	0

E.3.3 Scenario 3: Combined instruments

Measures applied:

- Subsidies/incentives for public transit — high → change transit modal share, reduce passenger vehicle travel
- Incentives for communications use → reduce passenger vehicle travel
- New CAFE standards — high → more efficient vehicles
- Urban traffic management — low → more efficient vehicles
- Inspection and maintenance programs → more efficient vehicles
- Passenger vehicle travel restrictions (20% reduction) → reduce passenger vehicle travel

Table E.3.3

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 3: Combined Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.95
25	Urban	Public	GO-Train	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.99	0.97	0.95
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.90	1.00	1.00	0.99	0.97	0.95
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.94	0.88	0.65	1.00	1.00	0.93	0.71	0.61
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.94	0.88	0.65	1.00	1.00	0.93	0.71	0.61
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.94	0.88	0.65	1.00	1.00	0.93	0.71	0.61
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.94	0.88	0.65	1.00	1.00	0.93	0.71	0.61
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.96	0.83	0.78
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.96	0.83	0.78
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.83	0.78
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.3.3

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 3: Combined Instruments

						CHANGE IN TRANSPORTATION DEMAND C' (I'C)						CHANGE IN EFFICIENCY D' (II'D)					
						Revised Vehicle Demand						Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.69E+09	1.80E+09	1.96E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.70E+09	1.81E+09	1.97E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.20E+08	1.28E+08	1.40E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	4.95E+09	5.28E+09	5.75E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.74E+06	6.02E+06	6.79E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.67E+10	3.77E+10	3.35E+10	MJ/pass.km	3.09E+00	3.01E+00	2.77E+00	2.01E+00	1.72E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.86E+09	3.31E+09	3.95E+09	MJ/pass.km	1.30E+00	1.22E+00	1.06E+00	7.90E-01	6.93E-01
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.57E+09	5.03E+09	4.73E+09	MJ/pass.km	5.85E+00	5.74E+00	5.09E+00	3.70E+00	3.10E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.92E+08	2.11E+08	1.98E+08	MJ/pass.km	5.08E+00	4.93E+00	4.37E+00	3.18E+00	2.66E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.62E+00	3.97E+00	3.70E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.55E+00	1.29E+00	1.18E+00
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.40E-01	4.27E-01	4.14E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.83E+07	1.94E+07	2.10E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.39E+09	3.59E+09	3.89E+09	MJ/pass.km	2.11E+00	2.11E+00	2.09E+00	2.05E+00	2.00E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.88E+06	4.14E+06	4.25E+06	MJ/pass.km	2.23E+00	2.23E+00	2.21E+00	2.16E+00	2.12E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.92E+06	1.21E+07	1.88E+07	MJ/pass.km	5.92E-01	3.28E+00	1.55E+00	1.88E+00	1.91E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.03E+09	1.78E+09	1.93E+09	MJ/pass.km	3.96E+00	3.74E+00	3.20E+00	2.32E+00	1.98E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.79E+10	4.74E+10	3.82E+10	MJ/pass.km	4.58E+00	4.50E+00	4.12E+00	2.94E+00	2.45E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.26E+09	4.55E+09	3.91E+09	MJ/pass.km	5.83E+00	5.74E+00	5.03E+00	3.59E+00	2.95E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.79E+08	1.91E+08	1.64E+08	MJ/pass.km	5.01E+00	4.93E+00	4.32E+00	3.08E+00	2.53E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.14E+09	5.10E+09	4.03E+09	MJ/pass.km	7.24E+00	7.13E+00	6.51E+00	5.47E+00	5.01E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.32E+08	6.93E+08	6.75E+08	MJ/pass.km	5.66E+00	5.57E+00	5.21E+00	4.28E+00	3.81E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.77E+00	3.17E+00	2.90E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	9.46E+00	7.77E+00	6.91E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
	TOTAL															

Table E.3.3

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 3: Combined Instruments

REVISED ENERGY USE — E' (C''D')

SCENARIO EMISSIONS

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (MegaJoules) 1988	1990	1995	2000	2005			Strategy Tonnes of CO2 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.93E+09	3.12E+09	3.40E+09		tonnes	180 342	187 375	206 896	220 377	240 093	
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.48E+09	1.57E+09	1.72E+09		tonnes	94 572	94 612	104 473	111 283	121 233	
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.10E+08	1.17E+08	1.28E+08		tonnes	6 787	6 790	7 497	7 986	8 700	
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.08E+10	2.27E+10	2.42E+10	2.64E+10		tonnes	1 403 880	1 458 577	1 610 547	1 715 539	1 868 940	
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.66E+10	3.84E+10	4.34E+10		tonnes	2 232 781	2 267 014	2 593 629	2 721 252	3 072 163	
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.02E+11	7.59E+10	5.76E+10	6	tonnes	6 683 943	6 960 600	6 909 585	5 162 122	3 914 631	
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	1.97E+09	2.62E+09	2.74E+09		tonnes	48 290	67 438	139 247	184 927	193 431	
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.32E+10	1.86E+10	1.47E+10		tonnes	1 584 182	1 599 428	1 578 735	1 267 010	996 814	
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.38E+08	6.72E+08	5.27E+08		tonnes	57 983	60 037	59 262	47 496	37 254	
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.29E+10	4.32E+10	4.63E+10		tonnes	2 793 483	2 820 366	2 918 329	2 939 640	3 143 892	
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.61E+10	4.89E+10	5.11E+10	11	tonnes	2 825 701	2 925 785	3 256 923	3 457 274	3 610 920	
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 036 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 184	388 828	454 124	519 900	
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454	
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 080	503 513	
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 888	554 396	626 499	651 106	684 243	
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.39E+09	1.46E+09	1.55E+09		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.04E+09	1.06E+09	1.10E+09		tonnes	68 125	69 660	73 445	74 953	77 989	
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.07E+09	7.35E+09	7.80E+09	26	tonnes	443 056	460 243	499 742	519 825	551 122	
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.55E+06	8.93E+06	9.00E+06		tonnes	511	532	581	607	612	
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.07E+06	2.27E+07	3.59E+07		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.30E+09	4.14E+09	3.84E+09		tonnes	83 829	118 817	233 435	292 525	271 355	
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	1.98E+11	1.39E+11	9.36E+10		tonnes	13 241 454	14 118 327	13 425 413	9 472 429	6 363 789	
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.14E+10	1.63E+10	1.15E+10	31	tonnes	1 493 131	1 536 705	1 456 606	1 109 956	782 460	
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	7.74E+08	5.89E+08	4.14E+08		tonnes	46 205	57 682	54 677	41 609	29 243	
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.35E+10	2.79E+10	2.02E+10		tonnes	2 363 984	2 424 810	2 276 785	1 896 632	1 371 384	
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.77E+09	2.97E+09	2.57E+09		tonnes	105 714	130 850	195 929	209 641	181 708	
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.19E+10	9.27E+09	7.38E+09		tonnes	878 445	884 666	808 947	629 961	501 582	
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.67E+10	2.62E+10	2.68E+10	36	tonnes	1 717 010	1 775 824	1 889 124	1 850 113	1 891 051	
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 498	95 000	102 338	115 173	
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 162	167 148	192 469	207 351	233 355	
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09		tonnes	363 667	372 563	428 995	462 166	520 114	
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 306	74 106	
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 408	96 592	94 580	92 609	90 885	
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811	
	TOTAL				0	6.15E+11	6.41E+11	6.51E+11	5.64E+11	5.02E+11			42 281 126	44 033 769	44 769 332	38 910 198	34 767 799	0
				RELATIVE TO 1988 ENERGY USE				105.8%	91.7%	81.7%		RELATIVE TO 1988 EMISSIONS			105.9%	92.0%	82.2%	

Table E.3.3

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	334	356	388		tonnes	3 668	3 811	4 206	4 482	4 883	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	676	720	785		tonnes	5 436	4 502	3 657	2 495	2 561	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	49	52	56		tonnes	916	830	831	793	851	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	79	84	91		tonnes	669	695	768	818	891	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	127	133	150		tonnes	1 064	1 081	1 236	1 297	1 464	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 210	1 651	1 252		tonnes	62 626	42 841	34 714	23 779	20 089	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	293	390	408		tonnes	676	869	1 885	2 947	3 552	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	505	405	319		tonnes	8 717	6 069	5 480	4 631	4 067	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	125	100	79		tonnes	208	197	195	188	178	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	933	940	1 005		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 864	7 286	7 610		tonnes	52 850	46 690	43 595	35 429	36 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 069	2 260		tonnes	21 125	21 078	23 694	26 278	28 678	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 536		tonnes	3 132	3 370	4 409	5 149	5 895	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307		tonnes	651	619	576	690	810	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025		tonnes	5 895	6 286	7 104	7 383	7 758	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	119	121	126		tonnes	1 385	1 417	1 494	1 524	1 586	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 234	3 364	3 566		tonnes	10 489	9 019	7 277	4 949	5 048	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4		tonnes	28	27	27	26	26	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	492	616	572		tonnes	387	512	1 049	1 585	1 741	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 293	3 029	2 035		tonnes	83 703	58 114	45 277	29 881	22 894	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	466	355	250		tonnes	8 253	5 831	5 108	4 183	3 360	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	115	88	62		tonnes	168	189	182	170	147	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	728	607	439		tonnes	14 065	10 003	9 255	8 157	6 084	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	413	442	383		tonnes	341	379	540	617	607	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	259	201	160		tonnes	426	395	358	297	255	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 981	3 899	3 985		tonnes	5 666	4 944	4 130	3 158	3 419	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6		tonnes	36	39	45	49	55	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11		tonnes	73	74	86	92	104	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25		tonnes	173	178	204	220	248	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53		tonnes	770	520	458	359	401	
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30		tonnes	668	601	533	468	451	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203		tonnes	3 160	2 297	2 420	2 518	2 782	
	TOTAL					0 32 842	33 889	35 899	35 768	36 017	0		0 306 597	242 704	220 464	185 259	180 681	0

Table E.3.3

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 3: Combined Instruments

SCENARIO EMISSIONS

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005	Units	Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	204	218	237	tonnes	198	206	227	242	263
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	430	415	443	tonnes	292	292	322	343	374
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	597	527	554	tonnes	136	136	150	160	174
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	878	935	1 019	tonnes	56	58	64	68	74
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0	tonnes	89	90	103	108	122
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	50 694	38 877	33 147	tonnes	10 809	11 560	12 490	12 833	11 384
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	594	993	1 224	tonnes	236	351	836	1 490	1 776
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 787	6 343	5 627	tonnes	1 353	1 394	1 553	1 712	1 608
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	61	63	61	tonnes	73	78	86	95	89
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814	tonnes	163	168	190	224	256
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 406	5 120	5 895	6 626	tonnes	2 835	3 025	3 840	4 872	5 591
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393	tonnes	1 140	1 137	1 278	1 418	1 547
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344	tonnes	182	196	256	299	342
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70	tonnes	179	170	158	189	222
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497	tonnes	435	442	465	515	553
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769	tonnes	342	365	412	429	450
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	73	74	77	tonnes	75	76	81	82	86
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	855	823	873	tonnes	563	584	641	681	737
27	Urban	Public	Bus	Gasoline	tonnes	34	20	19	17	17	tonnes	4	4	5	5	5
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	331	534	600	tonnes	135	202	465	801	871
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	66 119	48 853	37 774	tonnes	14 446	15 681	16 290	16 126	12 973
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 257	5 729	4 650	tonnes	1 281	1 339	1 447	1 546	1 328
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	57	57	51	tonnes	59	75	81	86	74
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 594	6 679	4 996	tonnes	1 632	1 700	1 748	1 733	1 370
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	170	208	209	tonnes	119	150	239	312	304
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166	tonnes	63	65	65	60	52
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591	tonnes	304	320	364	434	499
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63	tonnes	3	3	4	4	5
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119	tonnes	6	6	7	8	9
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284	tonnes	14	15	17	18	21
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661	tonnes	133	142	166	194	227
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293	tonnes	99	96	96	94	92
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284	tonnes	367	391	457	535	626
	TOTAL				0	241 480	190 347	165 902	126 731	108 534	0	0	37 820	40 520	44 604	47 717	44 104	0

Table E.3.3

SCENARIO EMISSIONS

Scenario 3: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 at least cost

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 486	1 524	1 682	1 792	1 952	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 199	2 207	2 386	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 827	4 198	4 192	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 453	2 613	2 847	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	3 951	4 145	4 680	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	370 653	289 122	250 444	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 430	2 450	3 000	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	64 875	55 526	49 793	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	148	156	151	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 367	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 508	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	597	609	634	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 376	4 377	4 702	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	168	136	128	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	796	1 318	1 470	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 036	577 447	463 432	363 318	285 406	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	60 461	50 147	41 143	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	138	141	124	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	78 974	60 772	45 849	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	409	513	513	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 736	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	18 761	20 965	
	TOTAL				0	1 895 797	1 344 440	1 169 388	931 527	796 550	0

Appendix E.4 Scenario 4: Twenty per cent reduction in CO_2 emissions relative to 1988 by 2005 with best position for future reductions

E.4.1 Scenario 1: Economic instruments

Measures applied:

- Carbon tax for 20% reduction → reduce fuel consumption 38 per cent
- Subsidies/incentives for public transit — high
- → increase transit mode split to 22 per cent
  → reduce urban travel demand 14 per cent
- Carbon tax — high → reduce passenger vehicle travel 5 per cent
- Incentives for communications use → reduce passenger vehicle travel 5 per cent

Table E.4.1

Scenario 4: Twenty per cent reduction in CO_2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 1: Economic Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.90	0.77	0.62
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	0.90	0.77	0.62
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.96	0.91	0.86	1.00	1.00	0.90	0.77	0.62
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.96	0.91	0.86	1.00	1.00	0.90	0.77	0.62
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.96	0.91	0.86	1.00	1.00	0.90	0.77	0.62
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.96	0.91	0.86	1.00	1.00	0.90	0.77	0.62
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25	Urban	Public	GO-Train	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.90	1.00	1.00	1.00	1.00	1.00
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.93	0.86	0.74	1.00	1.00	0.90	0.77	0.62
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.93	0.86	0.74	1.00	1.00	0.90	0.77	0.62
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.93	0.86	0.74	1.00	1.00	0.90	0.77	0.62
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.93	0.86	0.74	1.00	1.00	0.90	0.77	0.62
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
35	Urban	Freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
36	Urban	Freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.77	0.62
	TOTAL													

Table E.4.1

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 1: Economic Instruments

CHANGE IN TRANSPORTATION DEMAND — C' (TC)

CHANGE IN EFFICIENCY — D' (TD)

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Revised Vehicle Demand 1988	1990	1995	2000	2005		Revised Vehicle Efficiency 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.69E+09	1.80E+09	1.96E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.70E+09	1.81E+09	1.97E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.20E+08	1.28E+08	1.40E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	4.95E+09	5.28E+09	5.75E+09	MJ/pass.km	4.59E+00	4.59E+00	4.13E+00	3.54E+00	2.82E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.74E+06	6.02E+06	6.79E+06	MJ/pass.km	6.38E+03	6.38E+03	5.75E+03	4.92E+03	3.93E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.64E+10	3.70E+10	3.77E+10	MJ/pass.km	3.09E+00	3.01E+00	2.65E+00	2.13E+00	1.64E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.84E+09	3.24E+09	4.44E+09	MJ/pass.km	1.30E+00	1.22E+00	1.01E+00	8.36E-01	6.60E-01
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.52E+09	4.93E+09	5.32E+09	MJ/pass.km	5.65E+00	5.74E+00	4.87E+00	3.92E+00	2.95E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.90E+08	2.07E+08	2.23E+08	MJ/pass.km	5.08E+00	4.93E+00	4.16E+00	3.37E+00	2.53E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.29E+00	3.58E+00	2.79E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.43E+00	1.17E+00	8.86E-01
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.66E-01	1.39E-01	1.08E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	3.87E-01	3.31E-01	2.65E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	1.98E-01	1.65E-01	1.29E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	2.70E-07	2.31E-07	1.85E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.20E-07	6.16E-07	4.92E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.20E-07	6.16E-07	4.92E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	7.20E-07	6.16E-07	4.92E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.45E-01	4.41E-01	4.36E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.83E+07	1.94E+07	2.10E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.39E+09	3.59E+09	3.89E+09	MJ/pass.km	2.11E+00	2.11E+00	2.11E+00	2.11E+00	2.11E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.88E+06	4.14E+06	4.25E+06	MJ/pass.km	2.23E+00	2.23E+00	2.23E+00	2.23E+00	2.23E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.96E+06	1.25E+07	2.35E+07	MJ/pass.km	5.92E-01	3.28E+00	1.58E+00	1.94E+00	2.01E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.02E+09	1.74E+09	2.18E+09	MJ/pass.km	3.96E+00	3.74E+00	3.09E+00	2.54E+00	1.99E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.74E+10	4.65E+10	4.29E+10	MJ/pass.km	4.58E+00	4.50E+00	3.98E+00	3.21E+00	2.46E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.21E+09	4.45E+09	4.40E+09	MJ/pass.km	5.83E+00	5.74E+00	4.87E+00	3.92E+00	2.95E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.77E+08	1.87E+08	1.84E+08	MJ/pass.km	5.01E+00	4.93E+00	4.16E+00	3.37E+00	2.53E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.19E+09	5.26E+09	5.04E+09	MJ/pass.km	7.24E+00	7.13E+00	6.10E+00	5.09E+00	3.97E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.37E+08	7.14E+08	8.44E+08	MJ/pass.km	5.66E+00	5.57E+00	4.68E+00	3.98E+00	3.02E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.16E+09	2.92E+09	2.55E+09	MJ/pass.km	4.19E+00	4.12E+00	3.53E+00	2.95E+00	2.29E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.82E+09	3.37E+09	3.87E+09	MJ/pass.km	1.03E+01	1.01E+01	8.67E+00	7.22E+00	5.47E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	9.00E-01	7.70E-01	6.15E-01
	TOTAL															

Table E.4.1

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 1: Economic Instruments

REVISED ENERGY USE — E' (C"D')

Strategy Energy Use (MegaJoules)

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.93E+09	3.12E+09	3.40E+09
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.48E+09	1.57E+09	1.72E+09
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.10E+08	1.17E+08	1.28E+08
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.05E+10	1.86E+10	1.62E+10
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.30E+10	2.96E+10	2.67E+10
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	9.63E+10	7.87E+10	6.17E+10
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	1.87E+09	2.71E+09	2.93E+09
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.20E+10	1.93E+10	1.57E+10
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	7.94E+08	6.97E+08	5.64E+08
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	3.98E+10	3.90E+10	3.48E+10
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.27E+10	4.41E+10	3.85E+10
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	4.95E+09	4.95E+09	4.52E+09
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	4.95E+09	5.07E+09	4.75E+09
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	7.98E+09	7.09E+09	5.95E+09
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	4.67E+03	4.26E+03	3.66E+03
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.40E+09	1.50E+09	1.63E+09
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.04E+09	1.06E+09	1.10E+09
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	7.14E+09	7.58E+09	8.21E+09
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.63E+06	9.21E+06	9.48E+06
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.19E+06	2.42E+07	4.73E+07
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.16E+09	4.42E+09	4.33E+09
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	1.89E+11	1.49E+11	1.06E+11
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.05E+10	1.75E+10	1.30E+10
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	7.40E+08	6.29E+08	4.66E+08
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.17E+10	2.68E+10	2.00E+10
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.62E+09	2.84E+09	2.55E+09
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.12E+10	8.62E+09	5.85E+09
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.50E+10	2.43E+10	2.12E+10
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.21E+09	1.11E+09	1.00E+09
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.28E+09	2.10E+09	1.89E+09
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	5.45E+09	5.02E+09	4.52E+09
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.16E+08	7.17E+08	6.70E+08
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.25E+09	1.05E+09	8.20E+08
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	7.37E+09	7.38E+09	6.90E+09
	TOTAL				0	6.15E+11	6.41E+11	6.14E+11	5.41E+11	4.44E+11
						RELATIVE TO 1988 ENERGY USE		99.8%	88.0%	72.2%

SCENARIO EMISSIONS

Strategy

Tonnes of CO2

		1988	1990	1995	2000	2005	
1	tonnes	180 342	187 375	206 898	220 377	240 093	
2	tonnes	94 572	94 612	104 473	111 283	121 233	
3	tonnes	6 787	6 790	7 497	7 986	8 700	
4	tonnes	1 403 880	1 456 577	1 449 492	1 320 965	1 149 396	
5	tonnes	2 232 781	2 267 014	2 334 266	2 095 364	1 889 380	
6	tonnes	6 683 943	6 960 600	6 545 255	5 351 036	4 192 625	
7	tonnes	48 290	67 438	131 904	191 695	207 167	
8	tonnes	1 584 182	1 599 428	1 495 491	1 313 378	1 067 602	
9	tonnes	57 963	60 037	56 137	49 235	39 899	
10	tonnes	2 793 483	2 820 366	2 707 170	2 651 737	2 366 577	
11	tonnes	2 825 701	2 925 785	3 021 265	3 118 675	2 718 135	
12	tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	tonnes	276 181	297 184	349 945	349 675	319 738	
14	tonnes	501 341	476 603	399 130	408 945	383 424	
15	tonnes	0	0	0	0	0	
16	tonnes	0	0	0	0	0	
17	tonnes	0	0	0	0	0	
18	tonnes	396 820	402 367	423 757	469 060	503 513	
19	tonnes	519 888	554 396	563 849	501 351	420 809	
20	tonnes	1	1	0	0	0	
21	tonnes	0	0	0	0	0	
22	tonnes	0	0	0	0	0	
23	tonnes	0	0	0	0	0	
24	tonnes	68 125	69 660	73 445	74 953	77 989	
25	tonnes	443 056	460 243	504 790	535 902	580 129	
26	tonnes	511	532	587	626	644	
27	tonnes	0	0	0	0	0	
28	tonnes	83 829	118 817	223 360	312 608	305 921	
29	tonnes	13 241 454	14 118 327	12 845 974	10 122 767	7 174 428	
30	tonnes	1 493 131	1 536 705	1 393 739	1 186 161	882 132	
31	tonnes	46 205	57 662	52 318	44 466	32 968	
32	tonnes	2 363 984	2 424 810	2 154 928	1 818 343	1 358 309	
33	tonnes	105 714	130 850	185 443	200 967	179 975	
34	tonnes	878 445	884 666	757 995	585 839	397 440	
35	tonnes	1 717 010	1 775 824	1 770 135	1 720 533	1 498 417	
36	tonnes	80 529	82 496	85 500	78 801	70 831	
37	tonnes	163 162	167 148	173 222	159 660	143 513	
38	tonnes	363 667	372 563	386 098	355 868	319 870	
39	tonnes	0	0	0	0	0	
40	tonnes	43 381	46 202	48 675	48 747	45 575	
41	tonnes	97 406	96 592	85 122	71 309	55 771	
42	tonnes	446 559	475 591	501 047	501 793	469 129	
43	tonnes	42 281 128	44 033 769	42 204 020	37 272 325	30 631 415	0
		RELATIVE TO 1988 EMISSIONS		99.8%	88.2%	72.4%	

Table E4.1

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	334	356	388		tonnes	3 668	3 811	4 206	4 482	4 883	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	676	720	785		tonnes	5 436	4 502	3 657	2 495	2 561	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	49	52	56		tonnes	916	830	831	793	851	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	71	65	56		tonnes	669	695	691	630	548	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	114	102	92		tonnes	1 064	1 081	1 113	999	901	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 093	1 711	1 341		tonnes	62 626	42 841	34 364	23 289	22 600	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	278	404	437		tonnes	676	889	1 886	2 886	3 996	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	478	420	341		tonnes	8 717	6 069	5 425	4 536	4 575	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	118	104	84		tonnes	208	197	193	184	201	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	866	848	757		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 367	6 573	5 728		tonnes	52 850	46 690	43 595	35 429	38 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280		tonnes	21 125	21 078	23 694	26 276	28 676	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 035	1 035	946		tonnes	3 132	3 370	3 968	3 965	3 625	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 398	3 481	3 264		tonnes	651	619	518	531	498	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 668	1 484	1 245		tonnes	5 895	6 286	6 393	5 685	4 771	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	119	121	126		tonnes	1 385	1 417	1 494	1 524	1 586	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 267	3 468	3 754		tonnes	10 489	9 019	7 277	4 949	5 048	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4		tonnes	26	27	27	26	26	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	471	659	645		tonnes	367	512	1 038	1 552	1 959	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 106	3 237	2 294		tonnes	83 703	58 114	44 820	29 265	25 755	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	446	379	282		tonnes	8 253	5 831	5 056	4 096	3 780	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	110	94	69		tonnes	168	169	160	166	166	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	689	581	434		tonnes	14 065	10 003	9 348	8 410	7 605	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	391	424	379		tonnes	341	379	545	636	759	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	242	187	127		tonnes	426	395	358	297	255	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 731	3 626	3 158		tonnes	5 666	4 944	4 130	3 158	3 419	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	4	4	3		tonnes	38	39	41	38	34	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	8	7	7		tonnes	73	74	77	71	64	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	19	17	16		tonnes	173	178	184	170	152	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	35	35	33		tonnes	770	520	412	277	246	
42	Other	Other	School bus	Gasoline	tonnes	32	32	28	24	18		tonnes	668	601	460	360	277	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	133	133	125		tonnes	3 160	2 297	2 178	1 939	1 711	
	TOTAL				0	32 842	33 889	33 919	33 202	30 090	0	0	306 597	242 704	217 830	179 762	181 327	0

Table E.4.1

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	204	218	237		tonnes	196	206	227	242	263	
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	430	415	443		tonnes	292	292	322	343	374	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 066	632	597	527	554		tonnes	136	136	150	160	174	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	790	720	627		tonnes	56	56	57	52	46	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	93	83	75	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	50 182	38 075	37 290		tonnes	10 809	11 560	12 364	12 568	12 807	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	588	973	1 377		tonnes	236	351	827	1 459	1 998	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 706	6 212	6 331		tonnes	1 353	1 394	1 537	1 676	1 809	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	61	62	69		tonnes	73	78	86	93	100	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 406	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 416	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	905	904	827		tonnes	182	196	230	230	211	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	45	46	43		tonnes	179	170	142	146	137	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 458	1 296	1 088		tonnes	342	365	371	330	277	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	73	74	77		tonnes	75	76	81	82	86	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	855	823	873		tonnes	563	584	641	681	737	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	19	17	17		tonnes	4	4	5	5	5	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	327	523	675		tonnes	135	202	460	785	979	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	65 451	47 846	42 496		tonnes	14 446	15 681	16 126	15 794	14 595	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 184	5 610	5 231		tonnes	1 281	1 339	1 433	1 514	1 495	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	57	56	57		tonnes	59	75	80	84	83	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 711	6 885	6 245		tonnes	1 632	1 700	1 768	1 787	1 712	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	172	214	262		tonnes	119	150	242	321	380	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	257	198	166		tonnes	63	65	65	60	52	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	485	525	591		tonnes	304	320	364	434	499	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	47	43	39		tonnes	3	3	3	3	3	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	88	81	73		tonnes	6	6	6	6	5	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	210	194	174		tonnes	14	15	15	14	13	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	884	452	407		tonnes	133	142	149	149	140	
42	Other	Other	School bus	Gasoline	tonnes	792	457	548	239	180		tonnes	99	98	87	73	57	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	4 610	1 568	1 405		tonnes	367	391	411	412	385	
	TOTAL					0 241 480	190 347	163 591	123 191	117 183	0		0 37 825	40 520	44 114	46 617	47 442	0

Table E.4.1

SCENARIO EMISSIONS

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 1: Economic Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 486	1 524	1 682	1 792	1 952	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 199	2 207	2 386	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 827	4 196	4 192	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 208	2 012	1 751	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	3 556	3 192	2 878	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	366 909	283 160	281 749	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 416	2 400	3 375	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	64 219	54 381	56 018	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	146	153	169	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 686	1 687	1 543	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	2 720	2 419	2 030	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	586	597	609	634	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 376	4 377	4 702	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	168	136	128	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	788	1 291	1 654	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	478 549	355 827	321 082	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	59 850	49 113	46 286	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	136	138	140	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	79 771	62 652	57 312	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	414	529	641	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 513	1 574	1 257	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 484	2 793	3 185	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	130	120	108	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	246	227	204	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	586	542	487	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 426	3 365	3 072	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 364	1 906	1 366	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	18 587	14 446	12 894	
	TOTAL				0	1 895 797	1 344 440	1 156 104	908 771	870 597	0

E.4.2 Scenario 2: Regulatory instruments

Measures applied:

• New CAFE standards — high	→ reduce passenger vehicle fuel consumption 32 per cent → reduce truck fuel consumption 14 per cent
• Urban land use management — medium	→ reduce passenger vehicle travel 15 per cent
• Urban traffic management — medium	→ reduce urban fuel consumption 10 per cent
• Inspection and maintenance programs	→ reduce passenger vehicle fuel consumption 5 per cent
• Passenger vehicle travel restrictions	→ reduce passenger vehicle travel 20 per cent

Table E4.2

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 2: Regulatory Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.94	0.73	0.65
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.94	0.73	0.65
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.94	0.73	0.65
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.94	0.73	0.65
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	0.90
25	Urban	Public	GO-Train	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.97	0.95	0.90
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.97	0.95	0.90
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.91	0.69	0.58
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.91	0.69	0.58
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.91	0.69	0.58
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.91	0.69	0.58
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.94	0.81	0.74
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.94	0.81	0.74
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.94	0.81	0.74
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.98	0.92	0.85	1.00	1.00	0.94	0.81	0.74
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.4.2

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 2: Regulatory Instruments

						CHANGE IN TRANSPORTATION DEMAND C' (I'C') Revised Vehicle Demand					CHANGE IN EFFICIENCY D' (II'D') Revised Vehicle Efficiency					
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005		1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.72E+09	1.87E+09	2.06E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.74E+09	1.89E+09	2.08E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.23E+08	1.33E+08	1.47E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	5.05E+09	5.50E+09	6.05E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.85E+06	6.27E+06	7.15E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.75E+10	3.93E+10	3.52E+10	MJ/pass.km	3.09E+00	3.01E+00	2.77E+00	2.01E+00	1.72E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.90E+09	3.45E+09	4.15E+09	MJ/pass.km	1.30E+00	1.22E+00	1.06E+00	7.90E-01	6.93E-01
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.66E+09	5.24E+09	4.98E+09	MJ/pass.km	5.85E+00	5.74E+00	5.09E+00	3.70E+00	3.10E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.96E+08	2.20E+08	2.08E+08	MJ/pass.km	5.08E+00	4.93E+00	4.37E+00	3.18E+00	2.66E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.62E+00	3.97E+00	3.70E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.55E+00	1.29E+00	1.18E+00
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.31E-01	4.18E-01	3.93E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.87E+07	2.02E+07	2.21E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.39E+09	3.44E+09	3.48E+09	MJ/pass.km	2.11E+00	2.11E+00	2.05E+00	2.00E+00	1.90E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.88E+06	3.96E+06	4.02E+06	MJ/pass.km	2.23E+00	2.23E+00	2.16E+00	2.12E+00	2.00E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.92E+06	1.21E+07	1.88E+07	MJ/pass.km	5.92E-01	3.28E+00	1.55E+00	1.88E+00	1.91E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.07E+09	1.82E+09	2.01E+09	MJ/pass.km	3.96E+00	3.74E+00	3.13E+00	2.28E+00	1.88E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.94E+10	4.84E+10	3.97E+10	MJ/pass.km	4.58E+00	4.50E+00	4.04E+00	2.88E+00	2.32E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.39E+09	4.64E+09	4.07E+09	MJ/pass.km	5.83E+00	5.74E+00	4.93E+00	3.52E+00	2.79E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.84E+08	1.95E+08	1.70E+08	MJ/pass.km	5.01E+00	4.93E+00	4.24E+00	3.02E+00	2.39E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.04E+09	4.69E+09	3.42E+09	MJ/pass.km	7.24E+00	7.13E+00	6.38E+00	5.36E+00	4.74E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.21E+08	6.37E+08	5.74E+08	MJ/pass.km	5.66E+00	5.57E+00	5.11E+00	4.19E+00	3.61E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.09E+09	2.69E+09	2.17E+09	MJ/pass.km	4.19E+00	4.12E+00	3.69E+00	3.10E+00	2.74E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.77E+09	3.10E+09	3.29E+09	MJ/pass.km	1.03E+01	1.01E+01	9.27E+00	7.61E+00	6.54E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
	TOTAL															

Table E.4.2

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 2: Regulatory Instruments

REVISED ENERGY USE — E' (C''D')

Strategy Energy Use (Megajoules)

SCENARIO EMISSIONS — Strategy — Tonnes of CO2

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		1988	1990	1995	2000	2005			1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.99E+09	3.25E+09	3.58E+09		tonnes	180 342	187 375	211 120	229 580	252 729
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.51E+09	1.64E+09	1.81E+09		tonnes	94 572	94 612	106 605	115 920	127 614
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.98E+07	9.99E+07	1.13E+08	1.22E+08	1.35E+08		tonnes	6 787	6 790	7 650	8 319	9 158
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.98E+10	2.06E+10	2.32E+10	2.52E+10	2.78E+10		tonnes	1 403 880	1 458 577	1 643 415	1 787 019	1 967 305
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.74E+10	4.00E+10	4.57E+10		tonnes	2 232 781	2 267 014	2 646 560	2 834 638	3 233 856
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.04E+11	7.91E+10	6.06E+10	6	tonnes	6 683 943	6 960 600	7 050 597	5 377 211	4 120 664
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	2.01E+09	2.73E+09	2.88E+09		tonnes	48 290	67 438	142 088	192 632	203 611
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.37E+10	1.94E+10	1.54E+10		tonnes	1 584 182	1 599 428	1 610 954	1 319 803	1 049 278
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.56E+08	7.00E+08	5.55E+08		tonnes	57 983	60 037	60 471	49 475	39 214
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.29E+10	4.32E+10	4.63E+10		tonnes	2 793 483	2 820 366	2 918 329	2 939 640	3 143 892
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.61E+10	4.89E+10	5.11E+10	11	tonnes	2 825 701	2 925 785	3 256 923	3 457 274	3 610 920
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 060
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 184	388 828	454 124	519 900
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	396 820	402 367	423 757	469 080	503 513
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 888	554 396	626 499	651 106	684 243
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.36E+09	1.43E+09	1.46E+09		tonnes	0	0	0	0	0
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.06E+09	1.10E+09	1.16E+09		tonnes	68 125	69 660	74 944	78 076	82 094
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	6.93E+09	6.90E+09	6.61E+09	26	tonnes	443 056	460 243	489 646	487 894	467 156
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.37E+06	8.39E+06	8.05E+06		tonnes	511	532	569	570	547
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.07E+06	2.27E+07	3.59E+07		tonnes	0	0	0	0	0
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.34E+09	4.13E+09	3.78E+09		tonnes	83 829	118 817	235 792	292 061	267 457
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	2.00E+11	1.39E+11	9.23E+10		tonnes	13 241 454	14 118 327	13 561 023	9 458 058	6 272 368
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.16E+10	1.63E+10	1.13E+10	31	tonnes	1 493 131	1 536 705	1 471 319	1 106 272	771 219
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	7.81E+08	5.88E+08	4.08E+08		tonnes	46 205	57 682	55 230	41 546	28 823
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.22E+10	2.51E+10	1.62E+10		tonnes	2 363 984	2 424 810	2 186 173	1 706 924	1 104 325
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.85E+09	2.66E+09	2.67E+09	2.07E+09		tonnes	105 714	130 850	188 132	188 893	146 322
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.14E+10	8.35E+09	5.94E+09		tonnes	878 445	884 666	776 753	567 615	403 905
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.57E+10	2.36E+10	2.15E+10	36	tonnes	1 717 010	1 775 824	1 813 941	1 667 009	1 522 794
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 498	95 000	102 338	115 173
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 162	167 148	192 469	207 351	233 355
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09		tonnes	363 667	372 563	428 995	462 166	520 114
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 308	74 106
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 408	96 592	94 580	92 609	90 685
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811
	TOTAL				0	6.15E+11	6.41E+11	6.54E+11	5.63E+11	4.96E+11			42 281 126	44 033 769	44 977 760	38 867 465	34 362 687	0
						RELATIVE TO 1988 ENERGY USE		106.3%	91.6%	80.7%		RELATIVE TO 1988 EMISSIONS			106.4%	92.0%	81.3%

Table E.4.2

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005	Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	341	371	409	tonnes	3 668	3 811	4 293	4 668	5 140
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	690	750	826	tonnes	5 436	4 502	3 731	2 599	2 696
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	50	54	59	tonnes	916	630	848	828	896
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	80	87	96	tonnes	669	695	783	852	938
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	129	139	158	tonnes	1 064	1 081	1 261	1 351	1 541
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 255	1 720	1 318	tonnes	62 626	42 841	35 423	24 770	21 146
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	299	406	429	tonnes	676	689	1 924	3 070	3 739
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	515	422	336	tonnes	8 717	6 069	5 592	4 824	4 261
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	127	104	83	tonnes	208	197	199	196	188
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	933	940	1 005	tonnes	1 099	1 026	1 053	1 106	1 251
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 864	7 286	7 610	tonnes	52 850	46 690	43 595	35 429	36 307
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 069	2 280	tonnes	21 125	21 078	23 694	26 278	26 676
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 538	tonnes	3 132	3 370	4 409	5 149	5 895
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307	tonnes	651	619	576	690	810
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	665	758	814	tonnes	8 070	8 183	8 618	9 539	10 240
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025	tonnes	5 895	6 286	7 104	7 383	7 758
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	121	126	133	tonnes	1 385	1 417	1 524	1 588	1 670
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 169	3 157	3 023	tonnes	10 489	9 019	7 277	4 742	4 516
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	4	tonnes	28	27	27	25	25
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	497	616	564	tonnes	387	512	1 081	1 616	1 811
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 337	3 025	2 006	tonnes	83 703	58 114	46 677	30 464	23 818
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	471	354	247	tonnes	8 253	5 831	5 266	4 264	3 496
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	116	88	61	tonnes	168	189	187	173	153
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	699	546	353	tonnes	14 065	10 003	9 070	7 505	5 171
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	398	398	308	tonnes	341	379	529	567	516
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	248	182	129	tonnes	426	395	351	273	217
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 823	3 513	3 209	tonnes	5 666	4 944	4 048	2 905	2 907
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6	tonnes	36	39	45	49	55
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11	tonnes	73	74	86	92	104
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25	tonnes	173	178	204	220	248
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	tonnes	0	0	0	0	0
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53	tonnes	770	520	458	359	401
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30	tonnes	668	601	533	468	451
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203	tonnes	3 160	2 297	2 420	2 516	2 782
	TOTAL				0	32 842	33 889	35 766	35 213	34 656	0	0	306 597	242 704	222 866	186 562	181 842	0

Table E.4.2

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	208	227	250		tonnes	198	206	232	252	277	
2	Inter-city	Public	Bus	Diesel	tonnes	587	425	438	432	466		tonnes	292	292	329	357	393	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	609	549	583		tonnes	136	136	153	167	184	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	896	974	1 072		tonnes	56	58	65	71	78	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	105	112	128	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	51 728	40 497	34 892		tonnes	10 809	11 560	12 745	13 368	11 983	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	607	1 035	1 288		tonnes	236	351	853	1 552	1 870	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 946	6 607	5 923		tonnes	1 353	1 394	1 584	1 783	1 692	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	63	66	65		tonnes	73	78	88	99	94	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 416	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344		tonnes	182	196	256	299	342	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70		tonnes	179	170	158	189	222	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769		tonnes	342	365	412	429	450	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	74	77	81		tonnes	75	76	82	86	90	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	855	789	781		tonnes	563	584	641	652	659	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	19	16	16		tonnes	4	4	5	5	5	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	341	545	624		tonnes	135	202	479	817	906	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	68 164	49 806	39 300		tonnes	14 446	15 681	16 794	16 441	13 497	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 481	5 840	4 837		tonnes	1 281	1 339	1 492	1 576	1 382	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	59	58	53		tonnes	59	75	83	88	77	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 362	8 145	4 246		tonnes	1 632	1 700	1 713	1 595	1 164	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	167	191	178		tonnes	119	150	235	287	258	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	252	182	141		tonnes	63	65	63	55	44	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	475	483	503		tonnes	304	320	357	400	424	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63		tonnes	3	3	4	4	5	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119		tonnes	6	6	7	8	9	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284		tonnes	14	15	17	18	21	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661		tonnes	133	142	166	194	227	
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293		tonnes	99	98	96	94	92	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284		tonnes	367	391	457	535	626	
	TOTAL				0	241 480	190 347	169 184	129 182	111 516	0	0	37 820	40 520	45 446	48 561	45 148	0

Table E.4.2

SCENARIO EMISSIONS

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 2: Regulatory Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 717	1 867	2 055	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 244	2 299	2 511	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 946	4 373	4 412	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 503	2 722	2 997	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	4 032	4 318	4 926	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	378 217	301 168	263 625	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 459	2 553	3 156	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	66 199	57 839	52 414	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	151	163	158	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 426	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 508	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 614	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 506	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	568	609	635	668	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 376	4 195	4 207	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	188	130	121	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	820	1 343	1 530	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 038	577 447	498 384	370 404	296 934	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	62 330	51 125	42 805	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	142	144	129	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	77 394	55 911	38 972	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	401	472	436	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 463	1 448	1 069	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 434	2 570	2 706	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 738	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	18 781	20 965	
	TOTAL				0	1 895 797	1 344 440	1 193 813	949 296	818 526	0

E.4.3 Scenario 3: Combined instruments

Measures applied:

- Subsidies/incentives for public transit — high
  → increase transit mode split to 22 per cent
  → reduce urban passenger vehicle travel 14 per cent
- Incentives for communications use
  → reduce passenger vehicle travel 5 per cent
- New CAFE standards — high
  → reduce passenger vehicle fuel consumption 32 per cent
  → reduce truck fuel consumption 14 per cent
- Urban land use management — medium
  → reduce passenger vehicle travel 156 per cent
- Urban traffic management — medium
  → reduce urban fuel consumption 10 per cent
- Inspection and maintenance programs
  → reduce passenger vehicle fuel consumption 5 per cent
- Passenger vehicle travel restrictions
  → reduce passenger vehicle travel 20 per cent

Table E.4.3

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 3: Combined Instruments

					CHANGE IN TRANSPORTATION DEMAND COEFFICIENTS I. Vehicle Demand					CHANGE IN EFFICIENCY COEFFICIENTS II. Vehicle Efficiency				
NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	1988	1990	1995	2000	2005	1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
2	Inter-city	Public	Bus	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
3	Inter-city	Public	Bus	Gasoline	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
4	Inter-city	Public	Intra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
5	Inter-city	Public	Extra-air	Turbo	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
6	Inter-city	Private	Auto	Gasoline	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
7	Inter-city	Private	Auto	Diesel	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
8	Inter-city	Private	Light truck	Gasoline	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
9	Inter-city	Private	Light truck	Diesel	1.00	1.00	0.97	0.93	0.76	1.00	1.00	0.94	0.73	0.65
10	Inter-city	General freight	Truck	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
11	Inter-city	General freight	Truck	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.85	0.82
12	Inter-city	General freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	Inter-city	General freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	Inter-city	General freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	Inter-city	General freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Inter-city	General freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Inter-city	General freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Inter-city	Specific freight	Rail	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Inter-city	Specific freight	Marine	Diesel	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Inter-city	Specific freight	Marine	Heavy FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Inter-city	Specific freight	Marine	Light FO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22	Inter-city	Specific freight	Marine	Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	Inter-city	Specific freight	Marine	Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	Urban	Public	Streetcar&Subway	Electricity	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95	0.90
25	Urban	Public	GO-Train	Diesel	1.00	1.00	0.98	0.96	0.95	1.00	1.00	1.00	1.00	1.00
26	Urban	Public	Bus	Diesel	1.00	1.00	0.96	0.88	0.81	1.00	1.00	0.97	0.95	0.90
27	Urban	Public	Bus	Gasoline	1.00	1.00	0.96	0.88	0.77	1.00	1.00	0.97	0.95	0.90
28	Urban	Private passenger	Auto	Electricity	1.00	1.00	0.99	0.97	0.80	1.00	1.00	0.99	0.97	0.95
29	Urban	Private passenger	Auto	Diesel	1.00	1.00	0.92	0.81	0.56	1.00	1.00	0.91	0.69	0.58
30	Urban	Private passenger	Auto	Gasoline	1.00	1.00	0.92	0.81	0.56	1.00	1.00	0.91	0.69	0.58
31	Urban	Private passenger	Light truck	Gasoline	1.00	1.00	0.92	0.81	0.56	1.00	1.00	0.91	0.69	0.58
32	Urban	Private passenger	Light truck	Diesel	1.00	1.00	0.92	0.81	0.56	1.00	1.00	0.91	0.69	0.58
33	Urban	Non-freight	Truck	Gasoline	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.94	0.81	0.74
34	Urban	Non-freight	Truck	Diesel	1.00	1.00	0.97	0.89	0.68	1.00	1.00	0.94	0.81	0.74
35	Urban	Freight	Truck	Gasoline	1.00	1.00	0.96	0.92	0.85	1.00	1.00	0.94	0.81	0.74
36	Urban	Freight	Truck	Diesel	1.00	1.00	0.96	0.92	0.85	1.00	1.00	0.94	0.81	0.74
37	Aviation	General	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
38	Aviation	General	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
39	Aviation	Government	Airplane	Turbo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	Aviation	Government	Airplane	Aviation gas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	Other	Private	Motorcycle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
42	Other	Other	School bus	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
43	Other	Private	Leisure vehicle	Gasoline	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	TOTAL													

Table E.4.3

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 3: Combined Instruments

CHANGE IN TRANSPORTATION DEMAND — C' (TC)

CHANGE IN EFFICIENCY — D' (TD)

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Revised Vehicle Demand 1988	1990	1995	2000	2005		Revised Vehicle Efficiency 1988	1990	1995	2000	2005
1	Inter-city	Public	Rail	Diesel	pass.km/a	1.47E+09	1.53E+09	1.69E+09	1.80E+09	1.96E+09	MJ/pass.km	1.73E+00	1.73E+00	1.73E+00	1.73E+00	1.73E+00
2	Inter-city	Public	Bus	Diesel	pass.km/a	1.54E+09	1.54E+09	1.70E+09	1.81E+09	1.97E+09	MJ/pass.km	8.69E-01	8.69E-01	8.69E-01	8.69E-01	8.69E-01
3	Inter-city	Public	Bus	Gasoline	pass.km/a	1.09E+08	1.09E+08	1.20E+08	1.28E+08	1.40E+08	MJ/pass.km	9.17E-01	9.17E-01	9.17E-01	9.17E-01	9.17E-01
4	Inter-city	Public	Intra-air	Turbo	pass.km/a	4.32E+09	4.49E+09	4.95E+09	5.28E+09	5.75E+09	MJ/pass.km	4.59E+00	4.59E+00	4.59E+00	4.59E+00	4.59E+00
5	Inter-city	Public	Extra-air	Turbo	pass.km/a	4.94E+06	5.01E+06	5.74E+06	6.02E+06	6.79E+06	MJ/pass.km	6.38E+03	6.38E+03	6.38E+03	6.38E+03	6.38E+03
6	Inter-city	Private	Auto	Gasoline	pass.km/a	3.18E+10	3.40E+10	3.67E+10	3.77E+10	3.35E+10	MJ/pass.km	3.09E+00	3.01E+00	2.77E+00	2.01E+00	1.72E+00
7	Inter-city	Private	Auto	Diesel	pass.km/a	5.24E+08	7.80E+08	1.86E+09	3.31E+09	3.95E+09	MJ/pass.km	1.30E+00	1.22E+00	1.06E+00	7.90E-01	6.93E-01
8	Inter-city	Private	Light truck	Gasoline	pass.km/a	3.98E+09	4.10E+09	4.57E+09	5.03E+09	4.73E+09	MJ/pass.km	5.85E+00	5.74E+00	5.09E+00	3.70E+00	3.10E+00
9	Inter-city	Private	Light truck	Diesel	pass.km/a	1.62E+08	1.72E+08	1.92E+08	2.11E+08	1.98E+08	MJ/pass.km	5.08E+00	4.93E+00	4.37E+00	3.18E+00	2.66E+00
10	Inter-city	General freight	Truck	Gasoline	pass.km/a	7.96E+09	8.19E+09	9.28E+09	1.09E+10	1.25E+10	MJ/pass.km	5.17E+00	5.06E+00	4.62E+00	3.97E+00	3.70E+00
11	Inter-city	General freight	Truck	Diesel	pass.km/a	2.20E+10	2.35E+10	2.98E+10	3.78E+10	4.34E+10	MJ/pass.km	1.82E+00	1.76E+00	1.55E+00	1.29E+00	1.18E+00
12	Inter-city	General freight	Rail	Diesel	pass.km/a	6.08E+10	6.19E+10	7.32E+10	8.54E+10	9.80E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
13	Inter-city	General freight	Marine	Diesel	pass.km/a	1.84E+10	2.06E+10	2.98E+10	3.57E+10	4.19E+10	MJ/pass.km	2.13E-01	2.04E-01	1.85E-01	1.80E-01	1.75E-01
14	Inter-city	General freight	Marine	Heavy FO	pass.km/a	1.44E+10	1.37E+10	1.28E+10	1.53E+10	1.80E+10	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
15	Inter-city	General freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
16	Inter-city	General freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
17	Inter-city	General freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	4.30E-01	4.30E-01	4.30E-01	4.30E-01	4.30E-01
18	Inter-city	Specific freight	Rail	Diesel	pass.km/a	2.32E+10	2.40E+10	2.66E+10	3.10E+10	3.50E+10	MJ/pass.km	2.42E-01	2.37E-01	2.25E-01	2.14E-01	2.04E-01
19	Inter-city	Specific freight	Marine	Diesel	pass.km/a	2.90E+10	3.22E+10	4.03E+10	4.29E+10	4.63E+10	MJ/pass.km	2.53E-01	2.43E-01	2.20E-01	2.14E-01	2.09E-01
20	Inter-city	Specific freight	Marine	Heavy FO	pass.km/a	2.28E+10	2.15E+10	1.73E+10	1.84E+10	1.98E+10	MJ/pass.km	3.00E-07	3.00E-07	3.00E-07	3.00E-07	3.00E-07
21	Inter-city	Specific freight	Marine	Light FO	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
22	Inter-city	Specific freight	Marine	Kerosene	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
23	Inter-city	Specific freight	Marine	Coal	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	8.00E-07	8.00E-07	8.00E-07	8.00E-07	8.00E-07
24	Urban	Public	Streetcar&Subway	Electricity	pass.km/a	2.70E+09	2.81E+09	3.15E+09	3.41E+09	3.73E+09	MJ/pass.km	4.51E-01	4.49E-01	4.31E-01	4.18E-01	3.93E-01
25	Urban	Public	GO-Train	Diesel	pass.km/a	1.61E+07	1.67E+07	1.83E+07	1.94E+07	2.10E+07	MJ/pass.km	6.00E+01	5.91E+01	5.68E+01	5.46E+01	5.25E+01
26	Urban	Public	Bus	Diesel	pass.km/a	2.97E+09	3.09E+09	3.32E+09	3.31E+09	3.31E+09	MJ/pass.km	2.11E+00	2.11E+00	2.05E+00	2.00E+00	1.90E+00
27	Urban	Public	Bus	Gasoline	pass.km/a	3.38E+06	3.52E+06	3.80E+06	3.80E+06	3.62E+06	MJ/pass.km	2.23E+00	2.23E+00	2.16E+00	2.12E+00	2.00E+00
28	Urban	Private passenger	Auto	Electricity	pass.km/a	1.47E+06	3.29E+05	3.92E+06	1.21E+07	1.88E+07	MJ/pass.km	5.92E-01	3.28E+00	1.55E+00	1.88E+00	1.91E+00
29	Urban	Private passenger	Auto	Diesel	pass.km/a	3.00E+08	4.49E+08	1.01E+09	1.64E+09	1.64E+09	MJ/pass.km	3.96E+00	3.74E+00	3.13E+00	2.28E+00	1.88E+00
30	Urban	Private passenger	Auto	Gasoline	pass.km/a	4.25E+10	4.61E+10	4.70E+10	4.36E+10	3.24E+10	MJ/pass.km	4.58E+00	4.50E+00	4.04E+00	2.88E+00	2.32E+00
31	Urban	Private passenger	Light truck	Gasoline	pass.km/a	3.77E+09	3.94E+09	4.17E+09	4.18E+09	3.32E+09	MJ/pass.km	5.83E+00	5.74E+00	4.93E+00	3.52E+00	2.79E+00
32	Urban	Private passenger	Light truck	Diesel	pass.km/a	1.30E+08	1.66E+08	1.75E+08	1.76E+08	1.39E+08	MJ/pass.km	5.01E+00	4.93E+00	4.24E+00	3.02E+00	2.39E+00
33	Urban	Non-freight	Truck	Gasoline	pass.km/a	4.80E+09	5.00E+09	5.04E+09	4.69E+09	3.42E+09	MJ/pass.km	7.24E+00	7.13E+00	6.38E+00	5.36E+00	4.74E+00
34	Urban	Non-freight	Truck	Diesel	pass.km/a	2.64E+08	3.32E+08	5.21E+08	6.37E+08	5.74E+08	MJ/pass.km	5.66E+00	5.57E+00	5.11E+00	4.19E+00	3.61E+00
35	Urban	Freight	Truck	Gasoline	pass.km/a	3.08E+09	3.16E+09	3.09E+09	2.69E+09	2.17E+09	MJ/pass.km	4.19E+00	4.12E+00	3.69E+00	3.10E+00	2.74E+00
36	Urban	Freight	Truck	Diesel	pass.km/a	2.36E+09	2.49E+09	2.77E+09	3.10E+09	3.29E+09	MJ/pass.km	1.03E+01	1.01E+01	9.27E+00	7.61E+00	6.54E+00
37	Aviation	General	Airplane	Turbo	pass.km/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
38	Aviation	General	Airplane	Aviation gas	pass.km/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
39	Aviation	Government	Airplane	Turbo	pass.km/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
40	Aviation	Government	Airplane	Aviation gas	pass.km/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
41	Other	Private	Motorcycle	Gasoline	pass.km/a	6.38E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
42	Other	Other	School bus	Gasoline	pass.km/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
43	Other	Private	Leisure vehicle	Gasoline	pass.km/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10	MJ/pass.km	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
	TOTAL															

Table E.4.3

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 3: Combined Instruments

REVISED ENERGY USE — E' (C''D')

SCENARIO EMISSIONS

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE		Strategy Energy Use (MegaJoules) 1988	1990	1995	2000	2005			Strategy Tonnes of CO2 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	MJ/a	2.55E+09	2.65E+09	2.93E+09	3.12E+09	3.40E+09		tonnes	180 342	187 375	206 898	220 377	240 093	
2	Inter-city	Public	Bus	Diesel	MJ/a	1.34E+09	1.34E+09	1.48E+09	1.57E+09	1.72E+09		tonnes	94 572	94 612	104 473	111 283	121 233	
3	Inter-city	Public	Bus	Gasoline	MJ/a	9.96E+07	9.99E+07	1.10E+08	1.17E+08	1.28E+08		tonnes	6 787	6 790	7 497	7 986	8 700	
4	Inter-city	Public	Intra-air	Turbo	MJ/a	1.96E+10	2.06E+10	2.27E+10	2.42E+10	2.64E+10		tonnes	1 403 880	1 458 577	1 610 547	1 715 539	1 868 940	
5	Inter-city	Public	Extra-air	Turbo	MJ/a	3.15E+10	3.20E+10	3.66E+10	3.84E+10	4.34E+10		tonnes	2 232 781	2 267 014	2 593 629	2 721 252	3 072 163	
6	Inter-city	Private	Auto	Gasoline	MJ/a	9.83E+10	1.02E+11	1.02E+11	7.59E+10	5.76E+10	6	tonnes	6 683 943	6 960 600	6 909 585	5 162 122	3 914 631	
7	Inter-city	Private	Auto	Diesel	MJ/a	6.83E+08	9.54E+08	1.97E+09	2.62E+09	2.74E+09		tonnes	48 290	67 438	139 247	184 927	193 431	
8	Inter-city	Private	Light truck	Gasoline	MJ/a	2.33E+10	2.35E+10	2.32E+10	1.86E+10	1.47E+10		tonnes	1 584 182	1 599 428	1 578 735	1 267 010	998 814	
9	Inter-city	Private	Light truck	Diesel	MJ/a	8.20E+08	8.49E+08	8.38E+08	6.72E+08	5.27E+08		tonnes	57 983	60 037	59 262	47 496	37 254	
10	Inter-city	General freight	Truck	Gasoline	MJ/a	4.11E+10	4.15E+10	4.29E+10	4.32E+10	4.63E+10		tonnes	2 793 483	2 820 366	2 918 329	2 939 640	3 143 892	
11	Inter-city	General freight	Truck	Diesel	MJ/a	4.00E+10	4.14E+10	4.61E+10	4.89E+10	5.11E+10	11	tonnes	2 825 701	2 925 785	3 256 923	3 457 274	3 610 920	
12	Inter-city	General freight	Rail	Diesel	MJ/a	1.47E+10	1.47E+10	1.65E+10	1.83E+10	1.99E+10		tonnes	1 038 779	1 036 485	1 165 115	1 292 180	1 410 080	
13	Inter-city	General freight	Marine	Diesel	MJ/a	3.91E+09	4.20E+09	5.50E+09	6.42E+09	7.36E+09		tonnes	276 181	297 184	388 828	454 124	519 900	
14	Inter-city	General freight	Marine	Heavy FO	MJ/a	6.22E+09	5.91E+09	5.50E+09	6.59E+09	7.73E+09		tonnes	501 341	476 603	443 478	531 097	623 454	
15	Inter-city	General freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	16	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	MJ/a	5.61E+09	5.69E+09	6.00E+09	6.64E+09	7.12E+09		tonnes	398 820	402 367	423 757	469 080	503 513	
19	Inter-city	Specific freight	Marine	Diesel	MJ/a	7.36E+09	7.84E+09	8.86E+09	9.21E+09	9.68E+09		tonnes	519 886	554 396	626 499	651 106	684 243	
20	Inter-city	Specific freight	Marine	Heavy FO	MJ/a	6.85E+03	6.46E+03	5.19E+03	5.53E+03	5.96E+03		tonnes	1	1	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	21	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	MJ/a	1.22E+09	1.26E+09	1.36E+09	1.43E+09	1.46E+09		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	MJ/a	9.64E+08	9.86E+08	1.04E+09	1.06E+09	1.10E+09		tonnes	68 125	69 660	73 445	74 953	77 989	
26	Urban	Public	Bus	Diesel	MJ/a	6.27E+09	6.51E+09	6.79E+09	6.63E+09	6.28E+09	26	tonnes	443 056	460 243	479 853	468 378	443 798	
27	Urban	Public	Bus	Gasoline	MJ/a	7.52E+06	7.83E+06	8.21E+06	8.05E+06	7.25E+06		tonnes	511	532	558	547	493	
28	Urban	Private passenger	Auto	Electricity	MJ/a	8.70E+05	1.08E+06	6.07E+06	2.27E+07	3.59E+07		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	MJ/a	1.19E+09	1.68E+09	3.17E+09	3.73E+09	3.09E+09		tonnes	83 829	118 817	224 144	263 574	218 512	
30	Urban	Private passenger	Auto	Gasoline	MJ/a	1.95E+11	2.08E+11	1.90E+11	1.26E+11	7.54E+10		tonnes	13 241 454	14 118 327	12 891 108	8 534 952	5 124 525	
31	Urban	Private passenger	Light truck	Gasoline	MJ/a	2.20E+10	2.26E+10	2.06E+10	1.47E+10	9.27E+09	31	tonnes	1 493 131	1 536 705	1 398 636	1 000 104	630 086	
32	Urban	Private passenger	Light truck	Diesel	MJ/a	6.54E+08	8.16E+08	7.43E+08	5.30E+08	3.33E+08		tonnes	46 205	57 682	52 501	37 491	23 548	
33	Urban	Non-freight	Truck	Gasoline	MJ/a	3.48E+10	3.57E+10	3.22E+10	2.51E+10	1.62E+10		tonnes	2 363 984	2 424 810	2 186 173	1 708 924	1 104 325	
34	Urban	Non-freight	Truck	Diesel	MJ/a	1.50E+09	1.65E+09	2.66E+09	2.67E+09	2.07E+09		tonnes	105 714	130 850	188 132	188 893	146 322	
35	Urban	Freight	Truck	Gasoline	MJ/a	1.29E+10	1.30E+10	1.14E+10	8.35E+09	5.94E+09		tonnes	878 445	884 666	776 753	567 615	403 905	
36	Urban	Freight	Truck	Diesel	MJ/a	2.43E+10	2.51E+10	2.57E+10	2.36E+10	2.15E+10	36	tonnes	1 717 010	1 775 824	1 813 941	1 667 009	1 522 794	
37	Aviation	General	Airplane	Turbo	MJ/a	1.14E+09	1.16E+09	1.34E+09	1.44E+09	1.63E+09		tonnes	80 529	82 496	95 000	102 338	115 173	
38	Aviation	General	Airplane	Aviation gas	MJ/a	2.15E+09	2.20E+09	2.54E+09	2.73E+09	3.07E+09		tonnes	163 162	167 148	192 469	207 351	233 355	
39	Aviation	Government	Airplane	Turbo	MJ/a	5.13E+09	5.26E+09	6.06E+09	6.52E+09	7.34E+09		tonnes	363 667	372 563	428 995	462 166	520 114	
40	Aviation	Government	Airplane	Aviation gas	MJ/a	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	MJ/a	6.36E+08	6.80E+08	7.96E+08	9.31E+08	1.09E+09	41	tonnes	43 381	46 202	54 083	63 308	74 106	
42	Other	Other	School bus	Gasoline	MJ/a	1.43E+09	1.42E+09	1.39E+09	1.36E+09	1.33E+09		tonnes	97 408	96 592	94 580	92 609	90 685	
43	Other	Private	Leisure vehicle	Gasoline	MJ/a	6.57E+09	7.00E+09	8.19E+09	9.59E+09	1.12E+10		tonnes	446 559	475 591	556 719	651 679	762 811	
	TOTAL					0 6.15E+11	6.41E+11	6.38E+11	5.41E+11	4.68E+11			42 281 126	44 033 769	43 939 893	37 324 385	32 441 802	0
						RELATIVE TO 1988 ENERGY USE		103.8%	87.9%	76.1%		RELATIVE TO 1988 EMISSIONS			103.9%	88.3%	76.7%	

Table E.4.3

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	SCENARIO EMISSIONS Tonnes of SO2 Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of NOx Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	292	303	334	356	388		tonnes	3 668	3 811	4 206	4 482	4 863	
2	Inter-city	Public	Bus	Diesel	tonnes	612	612	676	720	785		tonnes	5 436	4 502	3 657	2 495	2 561	
3	Inter-city	Public	Bus	Gasoline	tonnes	44	44	49	52	56		tonnes	916	830	831	793	851	
4	Inter-city	Public	Intra-air	Turbo	tonnes	69	71	79	84	91		tonnes	669	695	768	818	891	
5	Inter-city	Public	Extra-air	Turbo	tonnes	109	111	127	133	150		tonnes	1 064	1 081	1 236	1 297	1 464	
6	Inter-city	Private	Auto	Gasoline	tonnes	2 137	2 226	2 210	1 651	1 252		tonnes	62 626	42 841	34 714	23 779	20 089	
7	Inter-city	Private	Auto	Diesel	tonnes	102	142	293	390	408		tonnes	676	889	1 885	2 947	3 552	
8	Inter-city	Private	Light truck	Gasoline	tonnes	507	511	505	405	319		tonnes	8 717	6 069	5 480	4 631	4 067	
9	Inter-city	Private	Light truck	Diesel	tonnes	122	127	125	100	79		tonnes	208	197	195	188	178	
10	Inter-city	General freight	Truck	Gasoline	tonnes	893	902	933	940	1 005		tonnes	1 099	1 026	1 053	1 108	1 251	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 955	6 166	6 864	7 286	7 610		tonnes	52 850	46 690	43 595	35 429	38 307	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 679	1 676	1 884	2 089	2 280		tonnes	21 125	21 078	23 694	26 278	28 676	
13	Inter-city	General freight	Marine	Diesel	tonnes	817	879	1 151	1 344	1 538		tonnes	3 132	3 370	4 409	5 149	5 895	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	4 268	4 057	3 775	4 521	5 307		tonnes	651	619	576	690	810	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	642	650	685	758	814		tonnes	8 070	8 183	8 618	9 539	10 240	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 538	1 640	1 854	1 927	2 025		tonnes	5 895	6 286	7 104	7 383	7 758	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	110	113	119	121	126		tonnes	1 385	1 417	1 494	1 524	1 586	
26	Urban	Public	Bus	Diesel	tonnes	2 867	2 978	3 105	3 031	2 872		tonnes	10 489	9 019	7 131	4 553	4 291	
27	Urban	Public	Bus	Gasoline	tonnes	3	3	4	4	3		tonnes	26	27	26	24	22	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	177	250	472	555	461		tonnes	387	512	1 028	1 458	1 480	
30	Urban	Private passenger	Auto	Gasoline	tonnes	4 234	4 515	4 122	2 729	1 639		tonnes	83 703	58 114	44 371	27 491	19 459	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	477	491	447	320	201		tonnes	8 253	5 831	5 005	3 848	2 856	
32	Urban	Private passenger	Light truck	Diesel	tonnes	97	122	111	79	50		tonnes	168	189	178	156	125	
33	Urban	Non-freight	Truck	Gasoline	tonnes	756	775	699	546	353		tonnes	14 065	10 003	9 070	7 505	5 171	
34	Urban	Non-freight	Truck	Diesel	tonnes	223	276	396	398	306		tonnes	341	379	529	567	516	
35	Urban	Freight	Truck	Gasoline	tonnes	281	283	248	182	129		tonnes	426	395	351	273	217	
36	Urban	Freight	Truck	Diesel	tonnes	3 619	3 742	3 823	3 513	3 209		tonnes	5 666	4 944	4 048	2 905	2 907	
37	Aviation	General	Airplane	Turbo	tonnes	4	4	5	5	6		tonnes	38	39	45	49	55	
38	Aviation	General	Airplane	Aviation gas	tonnes	7	8	9	9	11		tonnes	73	74	86	92	104	
39	Aviation	Government	Airplane	Turbo	tonnes	18	18	21	23	25		tonnes	173	178	204	220	248	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	31	33	39	46	53		tonnes	770	520	458	359	401	
42	Other	Other	School bus	Gasoline	tonnes	32	32	31	31	30		tonnes	668	601	533	468	451	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	119	126	148	173	203		tonnes	3 160	2 297	2 420	2 518	2 782	
	TOTAL					0 32 842	33 889	35 342	34 521	33 786	0		0 306 597	242 704	219 000	181 018	174 144	0

Table E.4.3

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Unit	SCENARIO EMISSIONS Tonnes of VOCs Emissions (G) 1988	1990	1995	2000	2005		Units	SCENARIO EMISSIONS Tonnes of Particulate Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	178	185	204	218	237		tonnes	198	206	227	242	263	
2	Inter-city	Public	Bus	Diesel	tonnes	567	425	430	415	443		tonnes	292	292	322	343	374	
3	Inter-city	Public	Bus	Gasoline	tonnes	1 086	632	597	527	554		tonnes	136	136	150	160	174	
4	Inter-city	Public	Intra-air	Turbo	tonnes	765	795	878	935	1 019		tonnes	56	58	64	68	74	
5	Inter-city	Public	Extra-air	Turbo	tonnes	0	0	0	0	0		tonnes	89	90	103	108	122	
6	Inter-city	Private	Auto	Gasoline	tonnes	73 117	58 822	50 694	38 877	33 147		tonnes	10 809	11 560	12 490	12 833	11 384	
7	Inter-city	Private	Auto	Diesel	tonnes	178	265	594	993	1 224		tonnes	236	351	836	1 490	1 776	
8	Inter-city	Private	Light truck	Gasoline	tonnes	12 698	8 816	7 787	6 343	5 627		tonnes	1 353	1 394	1 553	1 712	1 608	
9	Inter-city	Private	Light truck	Diesel	tonnes	55	59	61	63	61		tonnes	73	78	86	95	89	
10	Inter-city	General freight	Truck	Gasoline	tonnes	1 303	781	756	737	814		tonnes	163	168	190	224	256	
11	Inter-city	General freight	Truck	Diesel	tonnes	5 705	4 408	5 120	5 895	6 626		tonnes	2 835	3 025	3 840	4 872	5 591	
12	Inter-city	General freight	Rail	Diesel	tonnes	1 026	1 024	1 151	1 276	1 393		tonnes	1 140	1 137	1 278	1 418	1 547	
13	Inter-city	General freight	Marine	Diesel	tonnes	714	769	1 005	1 174	1 344		tonnes	182	196	256	299	342	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	57	54	50	60	70		tonnes	179	170	158	189	222	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	392	397	418	463	497		tonnes	435	442	465	515	553	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	1 344	1 434	1 620	1 684	1 769		tonnes	342	365	412	429	450	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	67	69	73	74	77		tonnes	75	78	81	82	86	
26	Urban	Public	Bus	Diesel	tonnes	1 132	851	838	758	742		tonnes	563	584	628	626	626	
27	Urban	Public	Bus	Gasoline	tonnes	34	20	19	16	14		tonnes	4	4	5	5	5	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	102	153	324	491	510		tonnes	135	202	456	737	740	
30	Urban	Private passenger	Auto	Gasoline	tonnes	97 725	79 791	64 796	44 945	32 108		tonnes	14 446	15 681	15 964	14 836	11 027	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	12 022	8 470	7 112	5 270	3 952		tonnes	1 281	1 339	1 418	1 422	1 129	
32	Urban	Private passenger	Light truck	Diesel	tonnes	44	56	56	53	43		tonnes	59	75	79	79	63	
33	Urban	Non-freight	Truck	Gasoline	tonnes	22 802	16 004	11 362	6 145	4 246		tonnes	1 632	1 700	1 713	1 595	1 164	
34	Urban	Non-freight	Truck	Diesel	tonnes	90	113	167	191	178		tonnes	119	150	235	287	258	
35	Urban	Freight	Truck	Gasoline	tonnes	505	301	252	182	141		tonnes	63	65	63	55	44	
36	Urban	Freight	Truck	Diesel	tonnes	612	467	475	483	503		tonnes	304	320	357	400	424	
37	Aviation	General	Airplane	Turbo	tonnes	44	45	52	56	63		tonnes	3	3	4	4	5	
38	Aviation	General	Airplane	Aviation gas	tonnes	83	85	98	105	119		tonnes	6	6	7	8	9	
39	Aviation	Government	Airplane	Turbo	tonnes	198	203	234	252	284		tonnes	14	15	17	18	21	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0		tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	899	720	982	588	661		tonnes	133	142	166	194	227	
42	Other	Other	School bus	Gasoline	tonnes	792	457	609	311	293		tonnes	99	98	96	94	92	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	5 123	3 676	5 345	2 062	2 284		tonnes	367	391	457	535	626	
	TOTAL				0	241 480	190 347	184 159	121 642	101 045	0	0	37 820	40 520	44 177	45 974	41 372	0

Table E.4.3 SCENARIO EMISSIONS

Scenario 4: Twenty per cent reduction in CO2 emissions relative to 1988 by 2005 with best position for future reductions

Strategy 3: Combined Instruments

NUMBER	SPATIAL	SECTOR	MODE	FUEL TYPE	Units	Tonnes of CO Emissions (G) 1988	1990	1995	2000	2005	
1	Inter-city	Public	Rail	Diesel	tonnes	1 466	1 524	1 682	1 792	1 952	
2	Inter-city	Public	Bus	Diesel	tonnes	2 444	2 107	2 199	2 207	2 386	
3	Inter-city	Public	Bus	Gasoline	tonnes	12 230	6 985	5 827	4 198	4 192	
4	Inter-city	Public	Intra-air	Turbo	tonnes	2 139	2 222	2 453	2 613	2 847	
5	Inter-city	Public	Extra-air	Turbo	tonnes	3 401	3 453	3 951	4 145	4 680	
6	Inter-city	Private	Auto	Gasoline	tonnes	613 547	425 693	370 653	289 122	250 444	
7	Inter-city	Private	Auto	Diesel	tonnes	424	624	1 430	2 450	3 000	
8	Inter-city	Private	Light truck	Gasoline	tonnes	99 950	71 265	64 875	55 526	49 793	
9	Inter-city	Private	Light truck	Diesel	tonnes	131	138	148	156	151	
10	Inter-city	General freight	Truck	Gasoline	tonnes	14 676	8 631	7 387	5 866	6 159	
11	Inter-city	General freight	Truck	Diesel	tonnes	23 765	21 851	26 219	31 339	35 684	
12	Inter-city	General freight	Rail	Diesel	tonnes	8 446	8 428	9 473	10 507	11 465	
13	Inter-city	General freight	Marine	Diesel	tonnes	1 332	1 434	1 876	2 191	2 508	
14	Inter-city	General freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
15	Inter-city	General freight	Marine	Light FO	tonnes	0	0	0	0	0	
16	Inter-city	General freight	Marine	Kerosene	tonnes	0	0	0	0	0	
17	Inter-city	General freight	Marine	Coal	tonnes	0	0	0	0	0	
18	Inter-city	Specific freight	Rail	Diesel	tonnes	3 227	3 272	3 446	3 814	4 094	
19	Inter-city	Specific freight	Marine	Diesel	tonnes	2 508	2 675	3 023	3 141	3 301	
20	Inter-city	Specific freight	Marine	Heavy FO	tonnes	0	0	0	0	0	
21	Inter-city	Specific freight	Marine	Light FO	tonnes	0	0	0	0	0	
22	Inter-city	Specific freight	Marine	Kerosene	tonnes	0	0	0	0	0	
23	Inter-city	Specific freight	Marine	Coal	tonnes	0	0	0	0	0	
24	Urban	Public	Streetcar&Subway	Electricity	tonnes	0	0	0	0	0	
25	Urban	Public	GO-Train	Diesel	tonnes	554	566	597	609	634	
26	Urban	Public	Bus	Diesel	tonnes	4 716	4 221	4 289	4 027	3 997	
27	Urban	Public	Bus	Gasoline	tonnes	379	226	184	125	109	
28	Urban	Private passenger	Auto	Electricity	tonnes	0	0	0	0	0	
29	Urban	Private passenger	Auto	Diesel	tonnes	243	359	780	1 212	1 250	
30	Urban	Private passenger	Auto	Gasoline	tonnes	820 036	577 447	473 764	334 252	242 595	
31	Urban	Private passenger	Light truck	Gasoline	tonnes	94 632	68 470	59 251	46 136	34 972	
32	Urban	Private passenger	Light truck	Diesel	tonnes	106	132	135	130	106	
33	Urban	Non-freight	Truck	Gasoline	tonnes	130 332	94 025	77 394	55 911	38 972	
34	Urban	Non-freight	Truck	Diesel	tonnes	214	266	401	472	436	
35	Urban	Freight	Truck	Gasoline	tonnes	5 690	3 324	2 463	1 448	1 069	
36	Urban	Freight	Truck	Diesel	tonnes	2 548	2 314	2 434	2 570	2 708	
37	Aviation	General	Airplane	Turbo	tonnes	123	126	145	156	175	
38	Aviation	General	Airplane	Aviation gas	tonnes	232	238	274	295	332	
39	Aviation	Government	Airplane	Turbo	tonnes	554	568	653	704	792	
40	Aviation	Government	Airplane	Aviation gas	tonnes	0	0	0	0	0	
41	Other	Private	Motorcycle	Gasoline	tonnes	7 545	5 213	4 917	4 370	4 995	
42	Other	Other	School bus	Gasoline	tonnes	8 925	5 052	3 736	2 475	2 222	
43	Other	Private	Leisure vehicle	Gasoline	tonnes	29 281	21 594	20 652	16 761	20 965	
	TOTAL				0	1 895 797	1 344 440	1 156 713	892 719	738 983	0

Appendix F Other measures considered

Appendix F Other measures considered

In addition to the measures considered in Appendix C, measures to bring about two other actions were examined because they are widely advocated as ways of reducing emissions or energy use in the transportation sector:

- alternative transportation fuels
- non-motorized transportation modes, particularly bicycles.

The analysis of these indicated that neither of these actions is likely to have a significant effect on energy use or emissions over the next fifteen years. The findings of the analysis are briefly summarized below.

F.1 Alternative fuels

A number of alternative fuels have been suggested as replacements for the traditional transportation fuels, gasoline and diesel. The search for alternative transportation fuels began in earnest during the early 1980s when energy self-sufficiency and security of supply became major considerations due to periodic shortages of petroleum-based fuels. While shortages of gasoline and diesel did not persist, interest in alternative fuels has persisted due to their potential to reduce air emissions from the transportation sector.

Alternative transportation fuels include some that are relatively common such as propane, natural gas, and ethanol blends; others that are in the early stages of commercialization such as reformulated gasoline, methanol, and electricity; and still others that are experimental such as hydrogen.

Unless there are significant advances in alternative fuels technology, the use of alternative fuels will have little or no impact on total energy consumption by, and emissions from, Ontario's transportation sector in 2005. As much as two to three percent of the Ontario motor vehicle fleet may be powered by propane and natural gas by 2005. While some emissions reductions are possible by using propane and natural gas, the emissions achieved in practice are modest, and the expected number of propane and natural gas-powered vehicles in 2005 will be too small to have a significant impact on air quality. The main attractions of propane and natural gas are security of supply and lower costs. However, the costs of propane and natural gas have been kept artificially low through government grants that offset some of the conversion costs and through lower taxes for propane and natural gas than for gasoline.

Methanol also offers the potential for reduced emissions, but technical problems (corrosiveness and toxicity) and higher costs (methanol contains only about half the energy content as gasoline but requires greater storage space) make it unlikely that methanol-powered vehicles will account for more than a fraction of one percent of the vehicle fleet by 2005.

Reformulated gasoline can effect reductions in HC and toxic emissions, although it is not yet widely available and will be slightly more expensive than current gasoline when it does become widely available. The use of reformulated gasoline can be required by regulation in areas where other measures fail to bring HC and toxic emissions below acceptable levels.

In the longer term, electricity and hydrogen as transportation fuels offer the potential to greatly reduce emissions from the transportation sector. However, the technical and cost problems (concerns regarding the battery capacity and recharging of electric vehicles; refuelling, storage and risk of fire of hydrogen vehicles) associated with their use as transportation fuels are unlikely to be solved in time for electricity and hydrogen to have an impact on fuel use by the transportation sector in 2005.

F.2 Bicycle transportation

Few data are available on levels of bicycle use in Ontario, however in all probability the percentage of distance travelled by bike is well below one per cent. The distance travelled is higher in some European nations, ranging from 2.0 per cent in Sweden to 8.0 per cent in Holland (CEC, 1989).

Several reasons have been advanced to explain the relatively low use of bicycles in Ontario, including the Ontario climate, safety, and urban density. Helsinki, with a climate comparable to Ontario's, maintains February ridership at 40 per cent of February levels, in part through clearing snow from bicycle paths with specially designed equipment, and the use of studded tires. Safety can be addressed through the construction and improvement of bicycle routes: construction of bicycle routes in Delft, Netherlands corresponded to a ten per cent increase in trips, and an increase in average trip distance to 3.9 km; Detmold FRG and Basel Switzerland

reported substantial increases in bicycle travel after constructing bicycle routes (Replogle,1983). Areas with higher urban densities tend to have shorter trip distances, increasing the attractiveness of bicycles and walking; a study in Japan indicated bicycle use for trips 4–6 km long was only half that of trips 2–4 km long, and continued to drop as trip distance increase (Replogle, 1983).

Numerous measures have been adopted outside Ontario to increase bicycle ridership, including such things as construction and maintenance of bicycle routes, and provision of parking facilities for bicycles (de Wit,1988;Replogle,1983). These have been shown to increase the number of trips made by bicycle. However, after substantial improvements to bicycle routes, Helsinki shows only 3.8 per cent of distance travelled is by bicycle. Toronto, having a climate and population density similar to Helsinki, will likely experience similar results. The Ontario average would be considerably lower, and thus the contribution of bicycles to reducing emissions or energy use in the Ontario transportation sector will be minimal, though the local impacts in certain urban areas of the Province may be significant.